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VOLUME 4, No. 7 JULY 1952

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WORLD CROPS

Editor: Sir Harold A. Tempany, C.M.G., C.B.E., D.SC., F.R.I.C.

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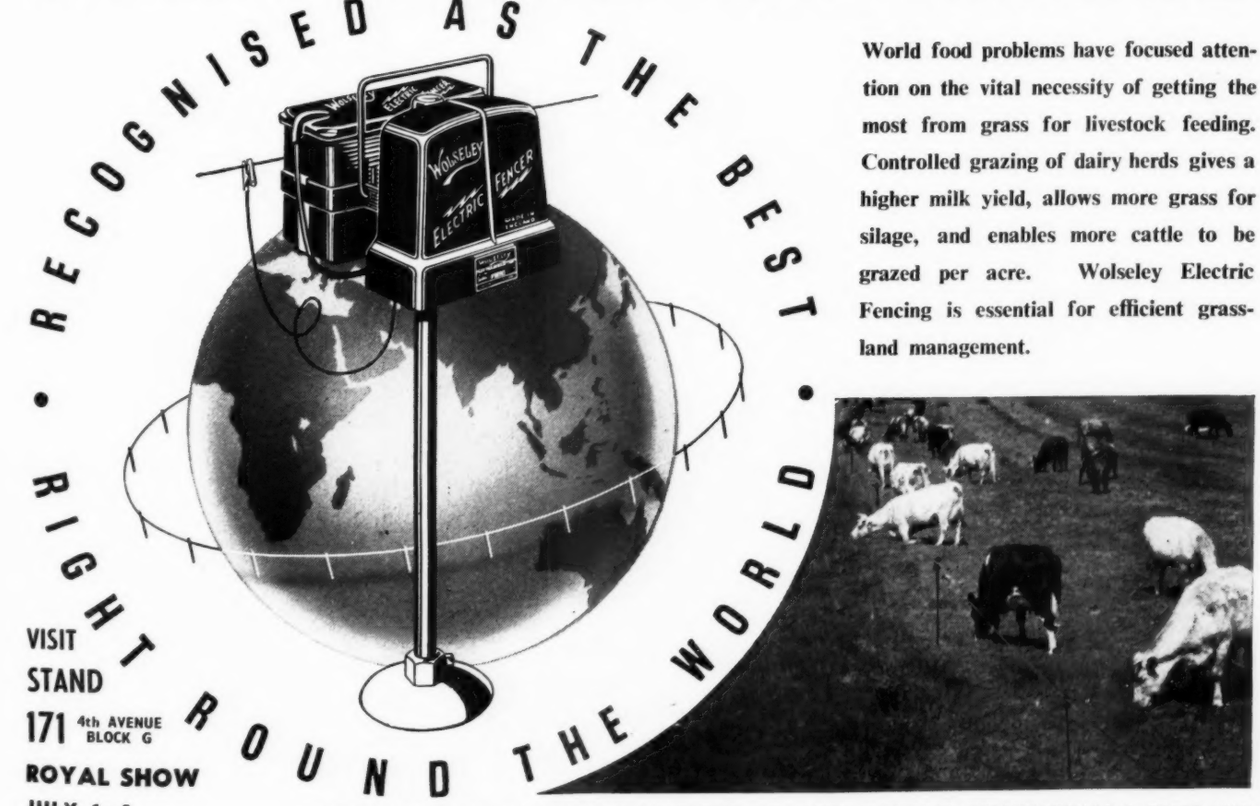

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Editorial Comment

Tobacco reflections

IN this issue we feature a number of articles on tobacco. It is indeed remarkable that, despite the fact that more than any other commodity, except perhaps potable alcohol, tobacco has for years been the favourite material for tax gatherers intent on wringing the uttermost farthing from the pockets of reluctant taxpayers, especially, we may add, in the United Kingdom, the area under tobacco cultivation shows no signs of diminishing nor does the output evince any tendency to decline. Indeed, although there have been noteworthy fluctuations in production in many countries, mainly due to fiscal and exchange considerations and varying weather conditions, on the whole the upward trend of production has continued unchecked. According to the latest figures furnished by the Commonwealth Economic Committee, production of tobacco in the U.S.A., which remains the largest producer, has increased from 1,386 million lb. in 1938-39 to 2,284 million lb. in 1951-52. Other countries have followed suit although on a smaller scale, especially countries in the British Commonwealth. Thus Canadian production has expanded from 101 million lb. in 1938-39 to 151 million lb. today. Southern Rhodesia is perhaps the most remarkable instance of all, where production has grown from 23 million lb. in 1938-39 to 117 million lb. in 1951-52, an increase of approximately 500 per cent. On this account special interest attaches to the two articles on the Southern Rhodesian tobacco industry which appear elsewhere.

So far as concerns imports of tobacco into the United Kingdom, last year the U.S.A. supplied approximately 312 million lb. weight; this was roughly equal to the average pre-war imports from the U.S.A. and represented a considerable advance on the preceding year when only 144 million lb. were imported from the U.S.A. Commonwealth imports into the U.K. now average about 130 to 140 million lb.

But the outstanding feature of the international tobacco situation at present is the cut which the U.K. is imposing on imports of tobacco from the U.S.A. in 1952 to save dollar exchange, amounting to no less than 43% of the 1951 imports, and the termination in July 1952 of ECA grants for imports of tobacco into Europe from the U.S.A.

What the effect of this will be is difficult to say; it seems that it must entail some reduction of tobacco production in the U.S.A. where at present roughly a quarter of the total out-turn of approximately 2,300 million lb. is exported.

It seems reasonable to assume that the shortage thus created will be made good from stocks which are reported to be considerable, and by further increased production in Commonwealth countries and in the countries of Europe where tobacco cultivation is already practised and showing signs of increasing. One thing, at any rate, appears clear and that is despite the attentions and exactions of the revenue authorities and the difficulties arising out of international agreements and disagreements the tobacco smoking propensities of the human race show no signs of falling off.

Gold Coast cocoa

THE news reported from the Gold Coast that the Government of that territory has decided to reimpose compulsory cutting out of cocoa found to be infected with swollen shoot disease need excite no suprise. When compulsory cutting was suspended, in common with others we expressed doubts whether it was entirely well-advised to abrogate compulsory powers of cutting out, notwithstanding the prospects of establishing control over the spread of the disease by means of the insecticide Hannane which had been shown to be lethal to the mealy bug vector of the disease if properly applied. It must be remembered that in spite of the high promise held out by the new insecticide, the only proved method of controlling the spread of the disease is the drastic one of cutting out; that this is the case has been stressed throughout by the British experts who have been working on the disease at the West African Cocoa Research Institute for the past eight years, and it is a verdict which was abundantly confirmed by the trio of virus experts appointed by the United Nations Organisation at the request of the Colonial Office.

Recent events seem to have shown that the decision to abandon compulsory powers of cutting out is now accepted as unduly hazardous, having regard to the extreme importance of the cocoa industry to the Gold Coast and the whole of West Africa. The so-called New Deal for cocoa appears to have been taken by the majority of the African cocoa planting community to be an indication that the disease was no longer officially considered to be as serious as formally; evidence of this seems to be their almost complete unwillingness to undertake cutting out on a voluntary basis despite the vast amount of propaganda undertaken. Indeed, there seems to be some ground for suspicion that propaganda in a contrary sense inspired by hostile foreign influences may not have been absent, with the idea that complete destruction of the cocoa industry in West Africa by the disease might pave the way for future Communist domination of West Africa.

Certainly accounts of the spread of the disease in the Gold Coast since the inception of the New Deal

are sufficiently alarming. It is reported that at the end of February there were nearly 3,300 known untreated outbreaks in New Deal areas and that in many areas the disease is undoubtedly spreading virtually unchecked.

So far as can be seen, if this had continued the end was assured. Let us hope that the resumption by the Government of compulsory powers combined with application of the new systemic insecticide at this eleventh hour may still avail to stay the threat. One cannot forbear from reflecting how ill political ideas and ideologies assort with the control of natural forces and epidemics of disease; it would almost seem that the ideas which imbued the courtiers of the late King Canute may not be altogether dead. It is well to bear in mind the truth of the old French proverb, *Chassez le naturel il revient au galop*.

Drought in Australia

IT is good news that rains have fallen in the far north of South Australia and in the central Australian region north and east of Alice Springs. Rains during the dry months of the year are a most unusual occurrence and these have come as a blessing to the Northern Territory, transforming the outlook there in what has so far been the most distressing season yet experienced.

We learn from a report in the London *Times* of May 24 that in the regions mentioned the rains have been sufficiently copious to enable stock to be moved to dry feeds and that the number of livestock saved will be very numerous.

In the Alice Springs region falls of up to two inches are reported, while at Oodnatta in South Australia falls of two and half inches have occurred in places.

Unfortunately these rains have not been continued up to the most northerly parts of the territory; north of Barrow Creek, on the Barkly Tableland and in the Gulf country of Queensland the drought continues unbroken and cattle continue to perish in consequence. This country is Australia's leading beef breeding area from which supplies of cattle are drawn for fattening further south.

Elsewhere in Australia conditions are variable. In Southern Queensland conditions are reported good and although there is some shortage of surface water there are ample stocks of grass feed. Elsewhere in Queensland, however, drought is fairly widespread in cattle country, *e.g.* north of Townsville and westward to Winton. In fact it is reported that almost a quarter of Queensland's total area has for months been suffering from drought. In Western Australia also it is reported to be still very dry in the Kimberley district, although light rains have been reported from Broome and Derby.

Australia is rightly regarded as having great potentialities as a source of the additional foodstuffs, notably meat and cereals, of which the world stands so greatly in need at present. In the circumstances the need for schemes to modify or mitigate the effects of her variable and erratic rainfall by irrigation wherever conditions are favourable seem to be more urgent than ever.

Irrigation set-back?

PROGRESS is often retarded by the uncalculated consequence and there is probably no field of applied science that has demonstrated this 'one-pace-forward-one-pace-backward' tendency more often than agriculture. A recent report from the United States reveals that government-sponsored irrigation schemes in the West, which have covered some 22 million acres of previously arid land, have not only turned the land into fertile farmland but also into a superb breeding-ground for mosquitoes. Something like a major problem in public health seems to have been created. At any rate, the U.S. Public Health Service has been obliged to intervene with an emergency team of 12 biologists and eight engineers, and it seems inevitable that this initial expenditure on scientific manpower will be insignificant compared with the later cost of necessary insecticides and their application. Even so, the addition to the budget of land reclamation that this totally represents will probably be small when set against the capital gain represented by making productive so many millions of poor or useless acres. Still, the power of the mosquito has once again been forcibly impressed into man's experience; at the same time that it is being conquered in some of its ancient strongholds, it has invaded new territories fortuitiously groomed for it.

Cereals Conference at Edinburgh

THE cereals conference held at Edinburgh on May 8 to 10, under the auspices of the Food and Agriculture Groups of the Society of Chemical Industry, a report of which appears on another page, was productive of some interesting discussion. In particular, attention may be called to the papers on cereal by-products by Messrs. K. D. Reid and J. Gordon Hay. In Great Britain alone cereal by-products such as straws, husks, brans, spent grains, etc., total as much as eight to nine million tons dry-weight annually. Milling offals and spent grains are used almost exclusively as feeding stuffs as is some of the straw, the remainder being principally used as the basis of farmyard manure.

Actually the industrial utilisation of these by-products has received far less attention in Britain than in a number of other progressive countries and, as several speakers at the conference emphasised, there appears to be scope for effective official action here.

The use of straw as a substitute for esparto grass in paper making was largely a wartime expedient and with the resumption of peacetime conditions it fell away sharply, but actually by using suitable equipment the production of straw pulp can be a remunerative and permanent industry. For example, Holland now sells Great Britain £2 million worth of straw-board annually.

Oat hulls for the production of furfural are extensively used in the U.S.A. and have been supplemented with ground maize cobs of recent years. Actually American production of furfural which is the principal starting point for manufacturing nylon amounts to some 50,000 tons per annum and seems likely to expand greatly in the near future.

So far Britain has been unable to produce furfural at a competitive price, largely because the supply of oat hulls has been too limited; nevertheless straw and other cereal residues also contain pentosans from which furfural can be produced.

As stressed at the conference, an opportunity for expansion in the industrial use of cereal residues in Great Britain seems to exist, and the suggestion that the Department of Scientific and Industrial Research should give serious consideration to setting up a research organisation to investigate the possibilities and to stimulate developments seems well worth consideration.

Hybrid maize

ONE of the most spectacular advances in agricultural practice achieved of recent years has been the development of hybrid maize cultivation in the U.S.A. which has been responsible for raising yields of that cereal in the corn belt by some 25% with appreciable diminution in the area cultivated. The development of additional vigour and yielding capacity in crops by hybridisation has already been discussed by Miss Ashton in WORLD CROPS, Vol. 1, p. 51, and its application to maize by Mr. E. S. Bunting, Vol. 2, p. 5.

In the U.S.A. the production of suitable strains of first generation hybrid seed has made enormous strides and has developed into an extensive commercial business; but until comparatively recently, development of the method in other parts of the world was restricted, if it existed at all, although much interest was aroused by the American efforts. Recently, thanks to the joint efforts of FAO and OEEC, the matter has advanced considerably. Trials have been inaugurated in 15 European countries and a series of meetings held at which progress has been reported and the various problems discussed.

The fifth of these meetings was held last February in Zurich, Switzerland, and attended by delegates from 13 European countries, as well as by representatives from a number of countries outside Europe and a number of observers from interested Institutions, notably Mr. M. T. Jenkins, Principal Agronomist in charge of corn investigations in the U.S.D.A.

Progress in Europe

IT transpires that under the auspices of FAO cooperative uniform tests of American maize hybrids were inaugurated in 1948 in a number of European countries. These were intended to acquaint workers in Europe and the Mediterranean countries with the range of hybrids available in the U.S.A. and to enable them to identify those best suited to their particular maize growing conditions. It is considered that these tests have now accomplished their primary purpose and it is proposed to discontinue supplying seed of American hybrids after the current season.

It is considered the aim should now be to develop inbred lines from varieties long acclimatised in European countries, since this holds out greater possibilities than the introduction of lines developed in other lands.

Maize from grain is an important crop in many southern European countries as well as in North Africa. In Northern Europe its main importance is as a silage crop. The requirements of varieties grown for these two purposes may be different. In Holland, however, noteworthy progress has been made in raising maize for grain, and a number of experimental double crosses have been tested with satisfactory results. All workers in Northern European countries agree that for growth under these conditions cold tolerance is extremely important and all breeding lines must be subjected to a cold test both as inbred lines and as top crosses.

In Italy a maize experiment station has been established at Bergamo, where a number of crosses are being tested. Commercial production of hybrid seed has risen 3,000 tons this year. Last year 2,000 tons were distributed, sufficient to plant 5% of the entire Italian maize area; it is estimated that this has increased maize production in Italy by at least 100,000 tons.

Maize is a valuable food and if these efforts fulfil the promise they evince, FAO and OEEC will have made a substantial contribution to increasing the food supplies of the world.

Colonial Development

THE Annual Report of the Colonial Development Corporation for 1951, recently published by the Stationery Office, is like its predecessors an interesting document. Since the appointment of Lord Reith as chairman of the Corporation the new policy then inaugurated has been pursued with vigour. Many of the schemes previously in operation have either been closed down or dras-

tically curtailed or modified, while very few new ones have been launched.

Some of the efforts which have been terminated, such as the Gambia Poultry Scheme, must be admitted, like the vast and grandiose East African groundnut scheme of the Overseas Food Corporation, to have been based upon insufficiently ascertained premises and over-optimistic assumptions; others, which have been continued in their original or in modified form, are considered to have fair prospects of ultimately achieving financial success.

But even if these hopes are realised one cannot help wondering whether a scheme of this type is really the most effective way of speeding the utilisation of undeveloped resources and agreeing with Mr. C. J. M. Allport in the *Daily Telegraph* of May 24, in questioning whether the embarking of publicly owned capital in a series of small and decidedly speculative ventures, such as a gold mine, a ranch, a fishery business, a tobacco plantation, and a tin mining company, are likely to be productive of much in the way of real value in the way of development or of adding greatly to the resources of individual territories even if they are fully successful, which seem to be by no means fully assured.

With all the spate of talk about colonial development of late years, an uninstructed observer might perhaps be pardoned for assuming that prior to the advent to power of the late Socialist-Labour Government in 1945, there had been no development in the British Colonies worthy of the name. Actually nothing could be further from the truth, and although progress might not have achieved all that could be desired, bearing in mind the relatively short time involved and the completely undeveloped character of many of the territories, the progress made is not as some would have us believe a thing to be ashamed of but a remarkable achievement with few, if any, parallels in human history.

We must, however, remember that most of those developments were assisted and accelerated by Government providing health, educational and transport facilities, maintaining law and order and scientific services, thereby creating an atmosphere in which development must flourish. It was the development of these, especially health, law and order and transport, which helped more than anything else to bring about the development of the rubber and tin industries in Malaya; it was the construction of the railway from Lagos to Kano which led to the establishment of the great groundnut industry in Nigeria; and the railway from the coast to the shores of Lake Victoria which led to the cotton and coffee industries of Uganda.

It seems to us that colonial development should concern itself rather with the strengthening and enlarging of those agencies which have assisted similar developments in the past rather than embarking on small-scale specific production schemes, except on pilot lines.

Medical rejects

IT can be said of antibiotics, as of Hollywood starlets, that only a few are chosen. Since penicillin, hosts of mould-derived chemical substances have been isolated but only a short list has been elevated to medical status. In many cases a good deal of private enterprise and capital has gone into their initial development and the would-be producers are not disposed to regard therapeutic failure as total failure. In the end agriculture may gain what medicine has turned down. Today there are two roads towards the use of antibiotics in agriculture—the ' pure ' road of fundamental research and the ' applied ' road of finding plant problems that unwanted antibiotics may help to solve. Progress may well be swifter along the latter.

Fire blight disease has been spreading with great severity in pear-growing districts east of the Rocky Mountains, and known fungicidal sprays have failed to give real control. The Missouri Agricultural Experiment Station reports promising results with very dilute antibiotic sprays; thiolutin, one of the medically unsuccessful class, has initially shown better results than streptomycin. The manufacturers of thiolutin, developing this hint, have tried out other market-seeking antibiotics and believe that terramycin may have even greater bactericidal effect upon the fire blight bacterium. The so-called halo blight of bean plants can be prevented by applying a 1% paste of streptomycin sulphate to the plant stem; of the other antibiotics so far tested only terramycin has displayed any similar controlling power but there are many other antibiotics to be tried out. The blue mould and black shank diseases of tobacco seedlings can be countered by thiolutin and rimocidin, and a mixture of these two antibiotics has been found to give good protection against the orange blue mould that attacks citrus fruit in storage.

None of these developments is yet established. In a new field of plant disease control we are seeing just the beginning of the beginning, a tenuous fragment of the future. It might be said that antibiotics are expensive and must on that ground exclude themselves from agriculture. Against this pessimistic view must be set two facts —first, the spray concentrations required are likely to be very low; second, lower standards of purity than those required for medical use may be quite adequate for agricultural application.

THIS MONTH'S COVER

Tobacco seed beds in Southern Rhodesia. *Extensive areas are used as insurance against failure.*

(Photo: Public Relations Dept. of Southern Rhodesia)

(*Left*) **Removing the most forward of the seedlings from a seed-bed for transplanting in the field.** (*Right*) **A field of typical flue-cured Virginia tobacco almost ready to start reaping the lower leaves; the plant under examination has been 'topped.' Pictures from Southern Rhodesia**

Tobacco Growing and Processing

JOHN GRINDROD, B.A. (Com.)

Tobacco is grown in many lands. Being a short season crop its cultivation can be undertaken with fair prospects wherever the summer is sufficiently prolonged; although it is essentially a crop of the warm latitudes it can be and is grown in many essentially temperate countries as well as in the tropics, wherever, in fact, soil and climatic conditions are suitable. The following article reviews the production of tobacco in the majority of countries in which it is grown.

ALTHOUGH tobacco is grown in most parts of the world and in a variety of soils, climates and other local conditions, the underlying methods of cultivation do not vary much.

Regions having a mean temperature of not less than 40°, and free from autumn frosts, give the best results, and the soil, whether it be clay or sand, should be porous and well-drained.

Outline of cultivation

Seeds are sown in nursery beds (about 300,000 to 400,000 go to the ounce) usually in late winter or early spring after the soil has been carefully prepared, manured and, if necessary, sterilised.

Planting out takes place when the shoots are 5 to 6 in. high; plants are set in rows, usually 1 to 4 ft. in width, according to the type of tobacco required. For example, in Cuba and Sumatra, where fine tobacco for cigars is required, the spacing is from 1 to 1½ ft.

Good cultivation is essential. Two months after planting, when the flower buds appear, these, together with the upper leaves, are pinched out or 'topped.' An exception is some Oriental tobaccos and, in Syria, where Latakia is grown. These plants are not 'topped' and the seeds, as well as all the leaves, are included in the curing. The plants are also grown close together, being 5 in. apart and from 9 to 12 in. between the rows. As they are small they produce delicate leaves only a few inches in length.

About a week or ten days after 'topping,' the plants throw out small 'suckers' which have to be removed when a few inches long, though in Florida these are sometimes left to produce a second, though inferior, crop.

Harvesting

Gradually the plant changes colour to a yellowish-green as the leaves ripen. For the best tobaccos the leaves are taken singly as they become ripe, the whole plantation being gone over several times during the harvest, but more usually the whole plant is cut when the middle leaves are ripe.

After cutting the leaves are attached to sticks or straddled on laths and carted for curing.

One of the important developments in tobacco farming in the United States during the last quarter of a century has been the growing of shade tobacco for cigar wrappers. This is protected from the sun by tent-like coverings of cheese cloth.

Curing

There are four methods of curing tobacco, varying largely with the type of tobacco and, to some extent, from country to country.

The most important is flue-curing, which is done usually in specially constructed barns. The heat is produced in an outside furnace and conducted through sheet-iron flues which run across the floor of the barn. The leaves are hung on sticks in tiers in the barn and curing takes place in three stages—yellowing the leaf, fixing the colour and drying out the stem.

The second method is sun-curing, when the leaves are exposed to the sun in rows on the ground until they turn reddish-brown.

Air-curing is done by allowing a current of air to flow through the leaves laid out on laths in the barn.

Fire-curing takes from one to six weeks and in this method the leaves are laid over trenches in which fires are lit, the smoke coming into direct contact with the leaf and turning it dark brown in colour.

Flue-curing is used for all the best

Virginia tobaccos, including most cigarette tobacco and much of the pipe tobacco used in this country. The three other methods cure the whole plant and are used chiefly for pipe tobaccos.

Oriental tobacco, grown chiefly in Turkey, Greece and other Balkan countries, has a much smaller leaf than the Virginian type and the leaves are picked as they mature and air- or sun-cured.

World Tobacco Congress of 1951

In Amsterdam, in September last, the producing countries met at the World Tobacco Congress, to which reports on tobacco cultivating and processing in each were submitted. These gave an up-to-date picture of the methods used in many producing countries and from these the following summary has been prepared.

The U.S.A.

All four methods of curing are used in the United States, but about 60% of the total production is flue-cured. The barns are usually of the kind already mentioned, but in some cases oil heaters are used without flues. Yellowing occurs at 80° to 100° F., drying begins at about 110° F., after which the temperature is gradually increased to about 135° to 145° F., while killing and drying the stem takes place at 160° to 200° F. Flue-curing takes four to five days.

The Turkish type of tobacco is sun-cured; Maryland, Burley, cigar and dark tobaccos are usually air-cured, while some kinds of tobacco, mainly used for the manufacture of snuff, are fire-cured in Kentucky, Tennessee and Virginia. Air-curing is often done in buildings, the ventilation of which can be controlled, and sometimes artificial heat is used. The process takes from one to three months. Before fire-curing the tobacco is hung for two or three days and the curing is done intermittently.

After drying, the tobacco is graded and marketed. After marketing, but before it is packed, conditioning of the tobacco is carried out by restoring the correct amount of moisture. The tobacco is then aged from one to three years, though in some cases this slow fermentation is quickened by adding water and fermenting in bulk.

Canada

In Canada, flue-curing is the normal procedure for bright cigarette tobaccos, while air-curing is adopted for cigar, Burley and pipe tobaccos. Usually the latter is done without artificial heat. Fire-curing is done only on a small scale. Most of the flue-cured tobacco is grown in south-western Ontario and a little in

Air-curing barn on a U.S. plantation. The air-curing is alternated with fire-curing by open fires built on the barn floor

Quebec. In Ontario, flue-cured tobacco growers are organised into associations which, in co-operation with the buying companies, have formed a flue-cured tobacco marketing association. This regulates acreage, appraises the cured leaf on farms prior to sale and fixes minimum average prices to be paid to growers. Burley growers also have their association. In Quebec crops are sold through farmers' co-operatives.

Conditioning in Canada is done in three stages; re-drying at a temperature of 110° to 200° F., cooling and then re-conditioning in which moisture is restored by means of steam and water. The tobacco is then packed and aged in warehouses.

South Africa

In South Africa air-, flue- and sun-curing are all adopted. Air-curing takes from three to eight weeks. One of the difficulties in air-curing is that if humidity is high during wet weather the process is slowed down and loss of colour results. Temperatures for flue-curing begin at 30° to 32° C., reaching a final figure of 71° C. Low heating efficiency, uneven distribution of humidity and heat are the principal problems in flue-curing.

Re-drying and ageing is done at co-operative warehouses, the moisture content of flue-cured tobacco being standardised at 10 to 12%. At the Rustenberg depot of the Magaliesberg Tobacco Farmers' Co-operative Society the tobacco 'hands' are put through a re-drying machine on a moving belt. In this the tobacco is first completely dried out then given the correct moisture content and then baled and stored from 18 to 24 months.

Fire-cured tobacco is not usually fermented but conditioned and baled. Air-cured leaves are fermented in stacks.

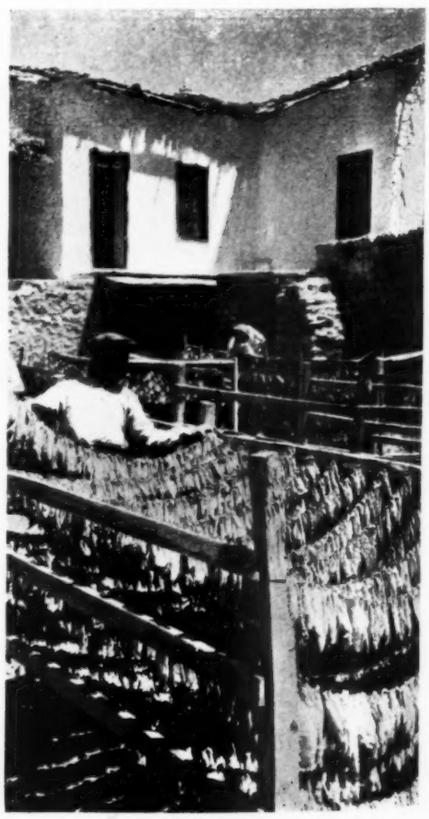
All marketing is done through the co-operative societies of which there are 11 in South Africa and Swaziland.

Southern Rhodesia

Southern Rhodesian tobaccos are mostly flue-cured in brick barns with controlled ventilation, the flues being heated by outside wood or coal furnaces or by inside oil burners without flues. After re-drying the tobacco is packed in wooden hogsheads.

India

India is the third largest producer of tobacco in the world, and Madras is by far the most important state, accounting for nearly 50% of the area under tobacco. Uttar Pardesh and Bihar together claim about 40% of the total acreage. Two species, *Nicotiana tabacum* and *Nicotiana rustica* are grown, producing cigarette, cigar, cheroot, bidi, chewing, hookah and snuff tobacco. Indian flue-cured and sun-cured Virginia provide the cigarette tobaccos, while White Burley and sun-cured 'Natu' country tobacco are used for other purposes. Both species are also grown in Pakistan. Sumatra and Manila tobaccos are grown in East Bengal, Desi



Drying tobacco in Ordu, Turkey

Picking tobacco on a Quebec farm

in the Punjab and Virginia in East Bengal and Western Pakistan.

Burma

Both air-curing and sun-curing are employed in Burma, the air-curing being done in the shade. This is done in special sheds of jungle wood and bamboo with a thatch roof and takes 20 to 40 days. The sun-curing process involves either slight bruising of the tobacco with a wooden mallet or shredding and, in either case, is completed in a few days. The shredded tobacco is moistened occasionally and packed in a damp condition. Fermentation takes place in heaps, which, in the case of shade-cured tobacco, are broken down and re-built four to six times, but only once or twice for the drier sun-cured types.

New Zealand

Almost all the New Zealand crop is flue-cured, and here again difficulty is experienced in getting uniform temperatures within the kiln. Either mechanically-operated coal-burning grates or oil-fed burners are used, but a modified type of kiln has been designed and experiments are being carried out in an endeavour to solve this problem. Re-drying and ageing in wooden cases follows the normal pattern.

Japan

In Japan all four methods of curing are employed as well as a mixture of air- and sun-curing. After re-drying the Virginia yellow type of tobacco is allowed to cool and then is stored in a sweating room at 50° C. and 92% air humidity. This lasts about 50 to 60 minutes, the water content of the leaf being less than 11%. It is then packed into hogsheads and aged in warehouses. This same type of tobacco is also treated in another way; it is put in small heaps, covered with a mat and allowed to ferment for about 19 days. Native-type tobacco is stacked and allowed to ferment for three to four weeks. Two of the chief Japanese difficulties appear to be determining the moisture content of the leaves before packing in hogsheads and promoting the ageing process.

Brazil

Leaf tobacco of Bahia, Brazil, is divided into two categories according to the process of drying—air-cured, whose leaves are dried in the shade or in a shelter; and flue-cured, whose leaves are artificially dried by a stove or furnace. Small quantities are also sun-dried or in the open air.

Europe

Tobacco is also grown commercially on the Continent of Europe, as, for example, in France, Switzerland, Germany and Austria.

The French use barns which have no special heating arrangements, or dry the leaves in the open. Fermentation is more complicated. After sorting the leaves are heaped and allowed to ferment at a moisture content of 27% to 28%. Heating takes place and when the temperature reaches a static level or 55° C., the tobacco is aerated and re-heaped.

Hot air is normally used for drying in Germany, though some tobaccos are conditioned in a re-drying machine. Cigar tobacco is fermented in bulk.

Flue-curing in Switzerland was found to give good colour but unsatisfactory quality. Consequently a number of other methods were adopted which produce tobaccos varying in colour and quality. Some tobaccos were partially sun-cured then dried naturally in barns.

Natural bulk fermentation has been discontinued in Switzerland except for cigar tobacco.

In Austria, light tobacco for cigarettes is withered in the light while cigar and chewing tobacco is withered in the dark. Since the war new artificial driers have been installed, the old hot-air driers having been destroyed, and ventilation and heated air are applied after withering.

Photos: p. 229, Public Relations Dept. of S. Rhodesia; p. 230 (top), U.S.I.S.; p. 231, Nat. Film Board of Canada.

Tobacco Production in Japan Since the War

In Japan, production and selling of tobacco is controlled by a monopoly. Until May 31, 1949, this was in the hands of the Government Monopoly Bureau, but on June 1, 1949, it was replaced by the Tobacco Monopoly Corporation, a public concern; the change was suggested by Gen. McArthur in 1948. Potential growers of tobacco have to obtain a licence from the Corporation before they are allowed to cultivate.

At the end of the war, in 1946, the tobacco acreage was only 22,000 chobus,* or less than 54% of the 1940 acreage. In that year the Government adopted a recovery programme and asked growers to increase their acreage to 50,000 chobus, with a consequent production of 80 million kg. of leaves after 1947. By 1949 this acreage was reached, and leaf production amounted to 82 million kg., the highest since 1943, when output was 84 million kg.

TOBACCO PRODUCTION IN JAPAN, 1936-49

Year	Chobus	Kilograms (in 1,000's)
1936	35,354	60,490
1937	34,909	63,937
1938	37,375	62,587
1939	43,487	85,528
1940	48,476	96,460
1941	46,497	82,874
1942	44,649	84,217
1943	43,792	84,246
1944	36,164	64,660
1945	31,100	36,066
1946	22,959	28,125
1947	41,861	58,003
1948	50,980	79,004
1949 (estimated) ..	50,693	82,736
1950 (estimated) ..	54,134	98,200
1951 (estimated) ..	54,090	95,340

*1 chobu = 2.45 acres.

The Southern Rhodesian Tobacco Industry

I. H. MORTEN

The development of tobacco growing in Southern Rhodesia is one of the more striking events in tobacco production. Especially during and since the war expansion has been particularly rapid. The following is an authoritative account of developments in this connection.

IT is important to remember that civilisation as we know it only started in Southern Rhodesia in 1890, and before then the written word or a turning wheel were unknown to and not understood by the African people there. Also, since then development has been hampered by five wars and much international unrest, in addition to droughts, pests and other local worries.

It is with this background that one must assess the prospects for the future.

Historical

It is not known how or when tobacco was first introduced into Southern Central Africa, possibly by the early Portuguese explorers or Arab slave traders coming from the Indian Ocean, but it is now fairly generally spread throughout the continent wherever soil and climate render its growth an economic possibility.

The first record of tobacco being produced in Rhodesia commercially was in 1894 near Umtali, when 57½ lb. were sold for 4s. 6d. a lb. By 1904 perhaps 100 farmers were producing Virginia type leaf in various districts, and it was then that the long and uphill path to acquire the best method of production, preparation and sale commenced.

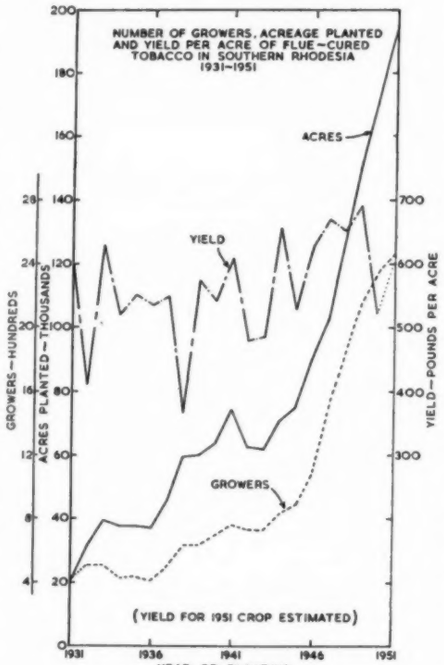
Parallel efforts were made by farmers interested in Oriental types of tobacco, who soon learned that hard work alone did not suffice to produce a commodity which could compete on world markets. So experts were brought in, while Rhodesians went abroad to learn the best methods of production, handling and manipulation.

From 1905 to 1910 flue-cured tobacco was sold by private negotiation between the farmer and the tobacco merchants, and in the latter year 100,000 lb. of the previous season's crop was sold by auction at an average of 1s. 2d. a lb.

Slowly production extended and by 1913 the crop had increased to 3,000,000 lb. However, in the following year the selling arrangements collapsed, many farmers became bankrupt and tobacco production declined below 1,000,000 lb. until after the first world war, when a co-operative society was formed, modern buildings and packing plants were installed and steps taken to enlarge markets.

This led to a marked increase in the crop from 2.4 million lb. in 1925 to 24.9 million lb. in 1928, though another and potent encouragement was provided by the Imperial Government introducing Imperial preferential tariffs on tobacco of one-sixth the full duty in 1919, one-quarter the full duty in 1925 and, from 1927 until 1943, a stabilised preference of 2s. 0½d. per lb., since reduced to its present figure of 1s. 6½d. per lb., or from 25% preference to the present less than 3%.

The crop of 24.9 million lb. in 1928 proved too great for visible markets to absorb, and a slump followed with many bankruptcies among the farmers. However, the industry struggled on until, in 1936, two modern auction floors were built and existing methods of sale were introduced.



Other types of tobacco

Fire-cured. Concurrently with these ups and downs a group of farmers in the Shamva district, farming a heavier soil than the flue-cured and Oriental tobacco growers, started to produce dark fire-cured tobacco. This has never assumed significant figures and will probably remain around 1,000,000 lb. production for the annual crop.

Cigar-leaf tobacco has also had its ups and downs and has disappeared completely more than once. Now a group of farmers in the Chipinga district, with its heavier rainfall and more humid atmosphere, has started to grow it again and followed steps taken by producers of other types of tobacco, securing the services of an expert from the Dutch East Indies. With the help of the Government and the Rhodesia Association of Flue-Cured Tobacco Growers, they have erected an up-to-date conditioning plant and when they are satisfied that their product warrants it will enter the world markets.

Areas cultivated

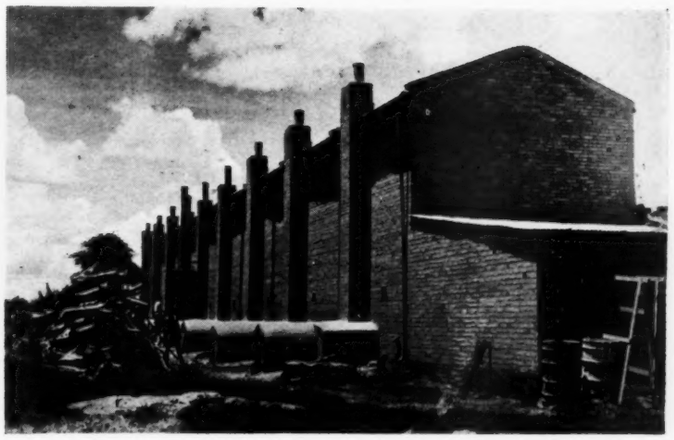
Flue-cured, fire-cured, Oriental and cigar-leaf tobaccos are all produced within an area of about 150 miles radius from Salisbury, the capital. Farms vary in size from a few hundred acres to several thousand, these relatively large sizes being due in part to the general poverty of the soil and in part to the early cheapness of land. Even 15 years ago farmland was available at fewer shillings to the acre than it would now fetch in pounds.

Flue-cured tobacco is, however, by far the most importand kind grown and at present some 2,500 farmers each cultivate a yearly average of 77 acres of this type of tobacco at an elevation of 4,000 to 5,000 ft. above sea level. The industry has made rapid advances since the auction sales were introduced in 1936 and the accompanying table shows the progress made between that year and the present.

At the time of writing—February 1952—an acreage around 192,000 is planted and the weather in February and March will decide the size and quality of the crop.

In the following paragraphs a brief account is given of the main features of flue-cured tobacco production as it is practised in Southern Rhodesia.

The Rhodesian's farming year consists of only two seasons, summer rainy season and



(*Left*) **Field of Southern Rhodesian flue-cured tobacco before 'topping.'** (*Right*) **Line curing barns in a row, furnaces and wood for the fires to the left. Halfway down is a boiler for steam-conditioning the leaves**

six months dry weather from April until October.

Normal rains are due in mid-November and frosts may occur from the end of May until early in July, so that the farmer must compress his crop production into these months, after the rains have set in.

Seed-beds are prepared as opportunity offers; the site is made up into brick-edged beds of 4 ft. 6 in. by, perhaps, 25 yd., each bed holding enough seedlings to plant out 1½ acres. The soil is sterilised, given a dusting of fertiliser, watered and the seed sown; it is essential to cover seedlings as soon as sown and never allow the seed-bed to dry out. After nine or ten days the seedlings appear, the plants are sprayed with a Bordeaux mixture and weeding carried out as necessary. As the plants grow they are gradually hardened off by removing shade for increasing periods daily until the earliest seedlings are ready for transplanting early in November.

Planting out

Tobacco is planted in newly cleared land, or in the same land for its second year, or in old land in the rotation tobacco, maize, green manure and ley. Land is ploughed and cross-ploughed and ridged at 3 ft. 6 in. intervals. Transplanting takes place every few days as weather permits until the New Year.

Within a few days of planting, the land is given a dose of complete fertiliser at a rate of from 100 to 250 lb. to the acre. A few weeks later this is repeated and once again if growth seems to be hanging fire.

Topping, seed selection

In Rhodesia priming is a cultural operation and not harvesting, as in the States; when a plant is about half-grown two, three or four of the lowest leaves are removed. When the plant has grown to its full height the seed heads form and the best plants are chosen for seed. These are enclosed in paper bags to prevent cross-fertilisation from less desirable plants. All the remaining flower-heads are snapped off to encourage the plant's vigour. The removal of the flower-head drives the plant to grow suckers at the axils of the leaves, and these have to be pinched out, perhaps three times.

About three months after planting out tobacco ripens and about mid-February harvesting starts, each ripe leaf being individually snapped off its parent plant, the idea being to harvest leaves of a uniform size, weight and ripeness.

FLUE-CURED TOBACCO PRODUCTION IN SOUTHERN RHODESIA, 1936-7 TO 1950-51

Year	*Number of growers*	*Acreage grown*	*Total sales*	*Average yield per acre*	*Net realisation by auction sales*
			lb.	*lb.*	£
1936-37 ..	419	36,939	19,818,254	536	786,879
1937-38 ..	493	45,657	25,016,980	548	1,075,161
1938-39 ..	638	59,689	21,608,533	362	882,396
1939-40 ..	638	59,957	34,426,535	574	1,748,179
1940-41 ..	693	63,740	34,637,234	543	2,225,892
1941-42 ..	756	74,376	45,966,025	618	2,854,401
1942-43 ..	741	62,216	30,284,490	479	2,256,990
1943-44 ..	713	60,543	30,601,167	505	2,758,861
1944-45 ..	796	71,047	46,721,691	657	3,856,431
1945-46 ..	862	74,420	41,641,086	560	5,600,818
1946-47 ..	1,158	90,757	57,438,350	633	6,957,811
1947-48 ..	1,460	112,605	74,680,149	663	10,123,825
1948-49 ..	1,778	125,968	81,722,214	649	10,850,160
1949-50 ..	2,100	152,717	104,262,802	683	16,348,180
1950-51 ..	2,349	172,000 (est.)	89,432,802	520 (est.)	12,884,551

Curing

The leaves are tied in bundles of three, four or five leaves to a stick about 4 ft. long and carried to the curing barn. The barns are brick-built structures 16 or 20 ft. square, usually built in rows; one barn is required for about each 7 acres. The barns have metal roofs with adjustable skylights for ventilation and are heated by metal flues about 11 in. dia., entering from an external furnace in the middle of one wall, dividing to go down each side wall, and out to the chimney alongside the furnace. Within the barn are racks from about 6 ft. off the floor up to near the roof and spaced apart the distance of rather more than a long tobacco leaf. The racks are filled with sticks of tobacco leaves and the furnace is lighted. From then until the end of the fourth day great care has to be taken to maintain the correct temperature, ventilation and degree of humidity.

For the first 36 to 48 hours the temperature is held at 90° F. and the leaves slowly wilt, a yellow colour extending slowly across the leaf. Then the colour is fixed by raising the temperature to around 130° F. When the optimum colour has been obtained and the leaf is dry the temperature is rapidly raised to 160° F. and held there until the mid-rib of the leaf is quite dry. Curing is then complete, the fire is drawn and the barn opened to cool off. The leaf is now exceedingly brittle and cannot be touched; as the season advances the grower cannot afford to wait until the leaf absorbs sufficient moisture from the atmosphere and steam is introduced into the barn. As they absorb 'condition' the sticks of cured leaves are removed and

stacked for 48 hours until the moisture has penetrated throughout the whole leaf. The leaves are then untied from the sticks and placed in a bulk to mature for six weeks with an occasional turn of top to bottom to prevent overheating or mould.

Grading

Grading is the preparation of leaf for sale by sorting every leaf by size, colour, texture, etc.

There are in all 90 grades, more than half of which will certainly be present in any one crop. Two consecutive grades may differ in selling price by as much as 1s. 6d. per lb.

When enough of one grade has been accumulated the leaves are tied into ' hands ' of 12 or more leaves and pressed into bales wrapped in waterproof Kraft paper and hessian.

Auction Sales

These are held five days a week from mid-April to the end of September. They are controlled by the Tobacco Marketing Board consisting of a senior Government official as chairman, three grower and two buyer members. The Board issues licences to buyers who act for manufacturers in most parts of the globe.

Buyers remove purchases to the re-handling and packing warehouse where the bales are opened up and sorted afresh, repacked and exported.

Research

With the expansion of the industry has come growing need for research to investigate the various problems of production.

To control developments a Tobacco Research Board has been set up in Salisbury, where are also located the headquarters of the Directorate of Research.

Research is financed jointly by the tobacco growers and the Government, the former contributing £60,000 and the latter £35,000 annually to the cost.

Conclusion

From what has been said, it will be obvious that the industry is vigorous and expanding. Tobacco accounts for upwards of one-third of Southern Rhodesia's export trade. Present world economic conditions have certainly helped latter-day developments, but it can safely be claimed that the major advances have been achieved the hard way and in the face of difficulties, both natural and economic. There is ample land available for further expansion of production and it is the intention of the Rhodesian producers further to expand production and improve the quality of the product so far as opportunity may permit.

Photos: Public Relations Dept. of S. Rhodesia.

Tobacco Research in Southern Rhodesia

F. A. STINSON

Director of Research to the Southern Rhodesia Tobacco Research Board

The rapid development of tobacco growing in Southern Rhodesia of late years has created many problems. To cope with these the Southern Rhodesia Tobacco Research Board has been set up. In the following, the problems are discussed and the manner in which they are handled is described.

THIRTY-SEVEN per cent. of the total value of Southern Rhodesia's exports are provided by flue-cured tobacco. To meet the demand, the area planted rose from 20,000 acres in 1931 to 190,000 acres in 1951, and the number of flue-cured tobacco farms from 400 to over 2,400.

In the early days with cheap and abundant land and labour it proved more advantageous to clear and plant large areas of new land than to go to the expense of buying seed and fertiliser to restore the soil. A big tobacco crop could be grown more profitably by planting a large acreage than by trying for a high yield.

In order that two or three tobacco crops might be grown before the land was let revert to weeds, even the stalks were taken off in an attempt to control diseases. Little commercial fertiliser was required, and although only light leaf lacking in character and flavour could be expected, there was a demand for this type as long as manufacturers could blend it with tobacco from other sources.

During this stage farmers' problems were confined mainly to controlling pests and finding varieties and methods for conveniently converting soil fertility into a marketable product. Research facilities were scarcely adequate to meet immediate demands and little attention was given to increasing the yield per acre.

At the same time as the industry extended, several changes and developments were taking place. The European population rose from 50,000 in 1931 to 135,000 in 1951 and created new demands for labour and land. Wages paid to African labour increased two and a half times and indications appeared that the output of work is decreasing and the labour supply is running out. The price of tobacco land has increased five to six times and the need for economy is forcing the farmer to maintain soil productivity so that he will not continually have to clear new land. He must also find ways of increasing the yield per acre while the larger the proportion of Rhodesian tobacco the manufacturer uses, the more emphasis will be placed on quality, uniformity and continuity of supply. The industry has in fact reached a stage when more attention must be paid to quality, and to economy in the use of labour and capital.

This sequence of events has occurred repeatedly in the growth of other agricultural industries, but it is perhaps significant that so many problems should be concentrated in such a short period.

The development of research

In anticipation of the problems the Rhodesia Tobacco Association in 1950 undertook with the Government of Southern Rhodesia to subsidise research on Virginia tobacco. By agreement, the growers through a crop levy contribute £60,000 and the Government grants £35,000 annually to finance the Tobacco Research Board in carrying on the work. The Board is a corporate body and includes representatives of the Rhodesia Tobacco Association.

Its functions are to develop methods whereby farmers may produce tobacco on a permanent basis. Permanency can only be a reality when suitable leaf is produced at a reasonable profit without impairing the land. The ability of farmers to adopt methods for maintaining soil productivity will determine the future of tobacco growing. Flue-cured tobacco has enabled a large area of farm land to be cleared and research is now needed to find ways of maintaining and utilising it, and preventing its reversion to waste.

Cropping system

The system of cropping is of fundamental importance. It should provide for soil productivity maintenance, and the control of soil-borne diseases and pests. Moreover, the alternative crops grown in a

rotation must not adversely affect the quality of the tobacco; indeed, in selecting and managing them the chief aim should be the improvement of tobacco yield and quality. In any case the soil and the climate limit the choice of rotation crops.

The soils on which flue-cured tobacco is grown in Southern Rhodesia range from coarse sands to sandy loams and the characteristics which make them suitable for tobacco present special problems in maintaining productivity, notably the coarse texture and the low humus content. Being chiefly of granitic origin, they are low in available fertility, while some are fairly acid.

Climatic functions

The climate is dominated by the altitude; most of the flue-cured tobacco is grown between 3,500 and 5,000 ft. The rainy season—November to March—has higher temperatures, especially at night, than the dry season. Owing to the high evaporation rate, soil temperatures are markedly influenced by the moisture contents. Rainfall is somewhat erratic and rains of high intensity, as well as drought periods, may be expected in the rainy season. Effective rainfall is not expected between May 1 and September 30. Air temperatures seldom go above 90° F., and freezing temperatures are rare.

Provision for experimental work

Work is under way at three research stations. One, 3,500 acres in area near Trelawney, serves one of the oldest tobacco growing districts and several types of soil are represented on it. A second station is established near Karoi in a district settled during the past few years. The soil here is generally more productive than in other districts, and rainfall is fairly reliable.

In 1951 work was begun on a station near Salisbury and provision made for the erection of greenhouse and laboratory facilities. In addition to field experiments, certain work for which special facilities are required will be developed at this central station. It is anticipated that field work will be needed at additional locations to adapt methods to all conditions.

Cultural problems

Each phase of production has its pressing problems and the intention is to develop research on a comprehensive scale as rapidly as is feasible. To evaluate soil-building crops, experiments with crop rotations were extended in 1951. Many excellent perennial grasses and several good annual legumes can be grown in Southern Rhodesia, and the usefulness of these in the tobacco rotation is under investigation.

Weeding tobacco seed-beds; other seed-beds covered with cheesecloth are in the background

Rapid decomposition makes it impracticable to build up the humus content of these tobacco soils. It has been demonstrated, however, that gross returns from flue-cured tobacco are related to the amount of suitable plant material and manure decomposing in the soil while the tobacco is growing. Field experiments have shown that where productivity is high, crops are less subject to the effect of drought as well as of excessive rainfall.

Closely related is the use of commercial fertilisers on tobacco as well as on other crops in the rotation.

Nitrogen

The problem of supplying nitrogen is complicated by the low exchange capacity and humus content of tobacco soils. Flue-cured tobacco is sensitive to small variations in available nitrogen, an excess or a shortage seriously affects quality and yield. Leaching and denitrification occur during prolonged cool, wet periods, while nitrification is very rapid when the weather is favourable. The requirements of tobacco for nitrogen are being investigated, as are the use of fractional applications and different sources. The amount of nitrogen required and timing applications are closely related to the cropping practice.

Phosphorus

Phosphorus nutrition presents a special problem. Phosphate fixation is thought to be considerable owing to the acidity of the soils, especially those poor in humus. The efficiency of indirect application of phosphates on soiling crops and of direct applications on tobacco where liming has been done previously are being studied.

Potassium

When first cleared, these soils appear to be fairly well supplied with potassium and, indeed, it is difficult to find typical symptoms of potash deficiency such as are common in some tobacco-growing areas. Southern Rhodesia tobacco's reputation for good burning qualities is an indication that a large proportion of its potassium comes from the soil rather than from fertiliser, as the latter contains a fairly high amount of chlorine. There is evidence that available potassium decreases rapidly when these soils are cropped. A close check is being kept on potassium fertilisation because of its importance to quality.

Magnesium

Magnesium deficiency symptoms, easily recognised by a complete loss of green colour between the veins of lower leaves, were first identified in tobacco during the past season. The occurrence of this deficiency, known as ' sand drown,' indicates that early consideration will have to be given to including magnesium in tobacco fertilisers. Plenty of high-grade dolomitic limestone rock (20% magnesium oxide) is available in the country, but it is not ground commercially for use on the land.

Trace elements

The question of trace elements in flue-cured tobacco has not yet been explored. The fact that beetroot cannot be grown without added boron, and that deficiencies of iodine and manganese are showing up in livestock, indicate that this subject should not be overlooked.

Fertiliser tests are not being confined to studies of minimum requirements. The

importance of balance of elements is recognised and fertilisation is viewed from the standpoint of how far it can go in economically improving tobacco production.

Pests and diseases

Root-knot nematode has long been a serious pest of flue-cured tobacco in this country and its prevalence seems to be increasing. A good deal is known about the crops which are hosts to this eelworm, but the effectiveness of crop rotations for reducing the loss it causes in tobacco has not been investigated thoroughly.

Soil fumigants for controlling root-knot eelworms have proved practicable in tobacco seedbeds, but owing to cost their use is not generally adopted in the soils. The recent discovery by Stokes of the Rhodesia Tobacco Association Mechanical Research Scheme, that eelworm may be electrocuted in the soil, has led to intensive studies to develop a method that may be applied on tractor-drawn farm implements.

Although breeding material resistant to root-knot nematode is available, no suitable resistant variety has been developed so far.

Another serious root disease of tobacco was first recorded in Southern Rhodesia in 1951. It affects the appearance and growth of tobacco in the same way as root-knot but does not produce root galls. The appearance of the roots is similar to that in a disease known in other tobacco-growing countries as ' nematode rootrot ' and ' brown rootrot.' The cause of this is being investigated.

Tobacco mosaic is a common leaf disease in Rhodesia, mainly owing to spread of the virus during the handling of seedlings and plants by labourers. Mosaic survives flue-curing and persists from one season to the next in tobacco refuse buried in the ground. The practice of pulling up and removing the stalks does not eliminate the source, as the disease persists in the broken roots. While the growing of two or more successive tobacco crops on the same land leads to losses from mosaic, a rotation in which a season intervenes eliminates contamination from the preceding crop.

Frog-eye and alternaria leaf spots are prevalent and the effect of crop rotation on their incidence is receiving attention. There are some indications that susceptibility to them depends on the physiology of the plant as affected by soil conditions, topping, suckering and stage of maturity. Attempts to discover material resistant to them have not been successful. Sanitation and spraying in seedbeds are useful for preventing infection and ' priming ' has also been recommended as a control measure.

Wildfire, formerly destructive, now appears to be less of a threat. The use of varieties with thicker leaves seems to have helped in reducing wildfire damage.

White mould attacks well-grown tobacco and often destroys leaves before they are ready to reap. Its prevalence seems to be increasing. The possibility of control with a fungicide is under observation but, provided it can be found, a resistant variety appears to offer the most practicable means of control.

Insects on tobacco present some unusual problems. Owing to the scarcity of other succulent vegetation early in the growing season, many insects that are readily controlled by spraying with insecticides, move on the seedbeds. At transplanting time mole crickets, white grubs, millepedes, false wireworms, cutworms, wireworms and grasshoppers frequently require control measures. White fly and aphids are common insect pests of the crops, but the budworm, while ubiquitous, seldom causes appreciable damage except in seed-heads. Insect control investigations are being conducted, but will need to be expanded considerably before the control situation can be considered satisfactory.

Other cultural investigations

Besides work aimed at developing varieties resistant to diseases, an active programme of variety testing is under way. Many imported varieties are being tested to classify their characteristics and several promising strains are being selfed, back-crossed and selected. The objective is to provide a small number of varieties suitable to all conditions in the country. Investigations of hybrid vigour as a means of improving tobacco are in progress also.

Methods of cultivation topping and suckering are being investigated. Control of suckers by means of chemicals is receiving intensive study in an effort to develop a better method than hand suckering, which is not only expensive but is often destructive as done by local labour.

Little experimental work was done on tobacco seedbeds prior to 1951. Large areas of seedbeds are usually planted as an insurance against failure and the practice is to move the seedbeds each year. The usual method of weed control is to burn brushwood on the beds, but shortage of brushwood and the high labour requirement are drawbacks. Burning is not, however, effective for disease control. Work was begun last season on partial sterilisation by steam, using the inverted pan method. This appears practicable for growers with a suitable portable boiler, but other methods of sterilisation are required for those who have not. Permanent seedbed sites are desirable for economy in the use of water, piping and land, but provision for efficient sterilisation is essential in a permanent site. Fertilisation, rates of seeding, and methods of watering, shading and ventilation of seedbeds are being studied.

Mechanisation

The amount of hand labour required for producing flue-cured tobacco in Southern Rhodesia is very high. Tractors have replaced oxen to a large extent for ploughing and preparing land, but it is doubtful whether many are being used to full advantage. Row crop equipment available is not suitable for Southern Rhodesian conditions and until each piece of equipment purchased can release labour or make labour efficient, it is not good business for the farmer to buy it. Development of suitable equipment for tobacco farming is urgent. Planting and fertilising are still done by hand, but these operations could be much more effectively done by machinery.

Irrigation

Overhead irrigation to lengthen the season in certain years and to save or improve portions of the crop when prolonged drought occurs, appears to have excellent possibilities. Moisture requirements of tobacco are low during the first weeks of growth, but a little extra at a critical time will keep the crop growing. Irrigation of tobacco seems to offer excellent research possibilities and plans are being made for its investigation.

Weather is so closely related to tobacco production that every possible effort is being made to increase the amount of weather data collected. In co-operation with the Meteorological Office of Southern Rhodesia, records are kept daily and at Karoi and Trelawney the records taken were increased considerably during 1951.

Conclusion

Problems connected with growing flue-cured tobacco in Southern Rhodesia are legion. None, however, appears insoluble. Many are, indeed, simple, while others require all the scientific skill and ingenuity that can be mustered. The Tobacco Research Board of Southern Rhodesia has an exceptional opportunity for the application of scientific knowledge to a rapidly growing industry of vital importance to the country.

Photo: Public Relations Dept. of S. Rhodesia.

Tobacco Farming in South Africa

D. F. RETIEF

Officer-in-Charge, Central Tobacco Research Station, Rustenburg

IT is generally accepted that no tobacco was cultivated in South Africa prior to the 16th century. Portuguese and other sailors spread the seed among the aborigines, but tobacco farming, as such, commenced only after the Dutch settlers had established themselves at the Cape.

As the population increased and farming enterprises spread to the inland areas of the Cape Province, tobacco commenced to come into prominence. In course of time areas suitable for cultivation were found and Oudtshoorn and districts farther inland became known for their particular products.

Since there were no factories the farmers had to process the product on their farms. They understood this art very well and the tobacco met with general approval. It was used principally in the form of pipe tobacco, but also for chewing and snuff. The first tobacco factory for the manufacture of roll tobacco was opened at Oudtshoorn in 1882.

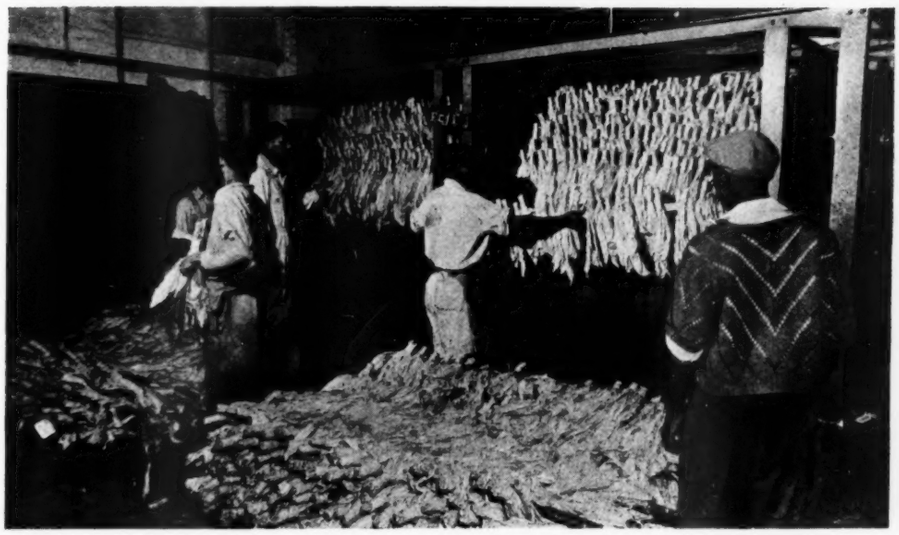
Areas suitable for the cultivation of tobacco were later found in the Magaliesberg and other parts of the interior and the trade in tobacco leaf expanded considerably.

First cigarette factory

As the population increased the demand for tobacco products increased to such an extent that it was necessary to supplement the local supplies with imports. Most of the imported tobacco came from the U.S.A. and was utilised principally for the manufacture of cigarettes. The first cigarette factory was erected shortly before the Union of South Africa was established. Today a large number of factories manufacture cigarettes, pipe, roll and snuff tobacco.

During the past 30 years the change in types of tobacco has been remarkable. In 1930-31 the total production of all types amounted to 21,750,000 lb. Of this, only 88,000 lb. was flue-cured, since this type had only just been introduced. In 1949-50 the total crop amounted to 41,500,000 lb., approximately 20,000,000 lb. of which was flue-cured. In 1947-48 the crop was a record one of almost 50,000,000 lb.

As a result of the completion of various irrigation schemes plantings have increased considerably. Also the marketing system and the protective legislation have encouraged a further increase in production.



Tobacco hands being placed on the moving belt of a redrying machine at the Rustenberg Depot of a farmers' co-operative society, South Africa. Tobacco takes 35 to 65 min. to pass through the machine, according to grade

Consumption in the Union

The Union's annual consumption was approximately 25,000,000 lb., but since 1939 the figure has risen sharply, and today is about 40,000,000 lb., half of which is flue-cured tobacco for the manufacture of cigarettes. There appears to be a tendency to over-production, especially of light tobacco, the cultivation of which has increased considerably, and active steps are being taken to create an export market for surplus tobacco and to grow the Orinoco type for flue-curing, as it is hoped that a readier demand exists for this type in overseas markets.

The most important tobacco areas are situated in the central, northern and eastern Transvaal and south-western and western Cape Province, along the Vaal River and in Natal. Turkish tobacco is grown in the western Cape Province, while Virginia varieties are cultivated in other parts of the Union. Virginia tobacco consists of the flue-cured, light and dark air-cured types. The Magaliesberg area produces about 70% of the total crop, and about 96% of the flue-cured tobacco grown in the Union. Dark or snuff tobacco is grown in the eastern Transvaal Low-veld, the northern Transvaal and in Natal. The climate in these areas is tropical or sub-tropical and the altitude usually less than 4,000 ft.

Co-operative marketing

Co-operative marketing has made it possible to standardise prices to such an extent that sudden fluctuations on the home market are eliminated. A uniform standard of tobacco grades is maintained throughout the Union. The societies have at their disposal the necessary machinery and trained staff to improve the product so as to be acceptable to manufacturers. The societies can also avail themselves of reserve funds which can be advanced to their members in payment of leaf delivered. Various other facilities are offered, like the provision of fertiliser, farm implements, cheesecloth, etc., at reasonable prices, as well as an insurance scheme against damage by hail. By means of circulars and personal contacts members are also kept informed of improved methods of cultivation and processing.

Profitability

An economic investigation recently carried out in the principal tobacco-producing areas in the Transvaal revealed that the average profit is approximately £50 per morgen. Under favourable conditions enterprising farmers can depend on an even greater profit per morgen. Production costs are necessarily high, since irrigable land is usually very expensive and harvesting requires much manual labour. The cultivation of tobacco cannot be completely mechanised.

There are approximately 17,000 tobacco farmers in the Union and, although they also engage in other branches of farming, about 86% of their income is derived from tobacco. This figure reflects the extent to which tobacco farming is specialised in the principal tobacco-farming areas.

The value of the crop to farmers is

approximately £5,000,000 per annum. The annual income to the State is about £11,000,000.

There are more than 20 manufacturers; they produce various tobacco products in approximately 45 factories and employ about 7,000 workers. The factories produce approximately 17,000,000 lb. of pipe and roll tobacco and 9,000,000,000 cigarettes per annum. With regard to cigarettes, this means that the daily consumption approximates to 23,000,000. In all, approximately £26,000,000 is spent annually by the smoking public on the various tobacco products.

From 'Farming in South Africa' (Special van Riebeck number), 1952.

Brazilian Tobacco

In Brazil tobacco production is carried on in almost every state, although Rio Grande do Sul and Bahia together account for over half of the total. Generally speaking, the northern states produce mainly air-cured dark, cigar types and in the southern states light, air-cured types predominate.

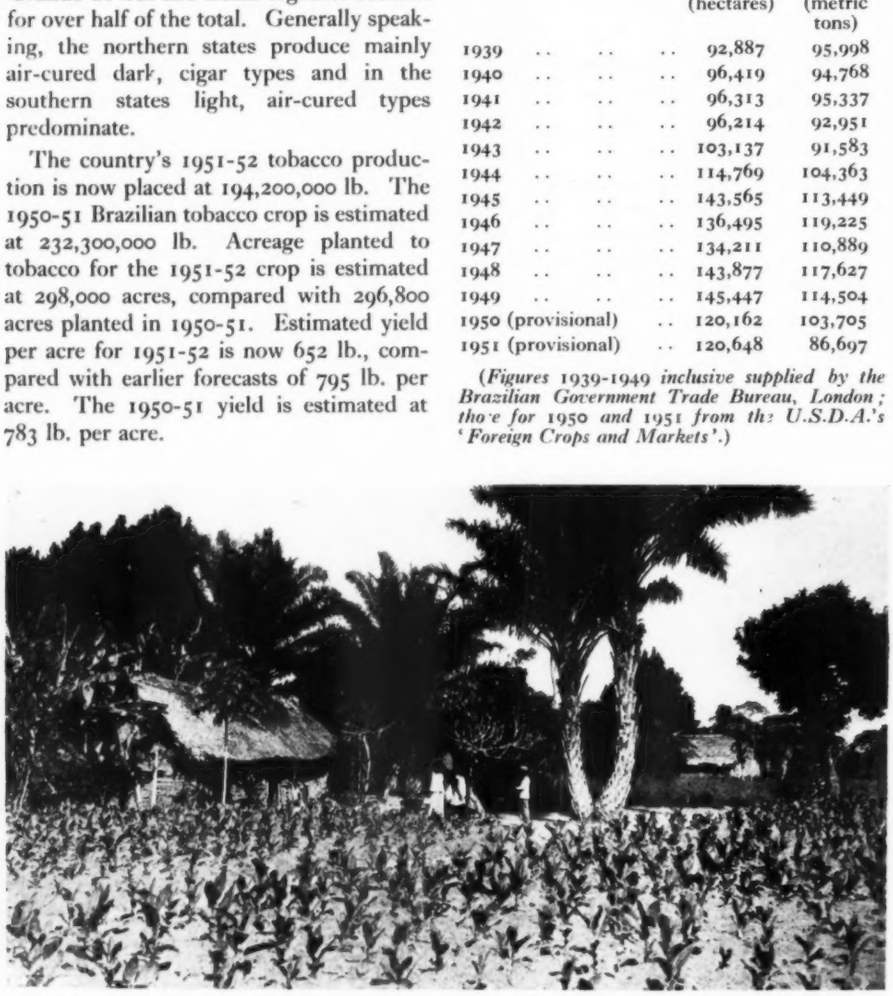
The country's 1951-52 tobacco production is now placed at 194,200,000 lb. The 1950-51 Brazilian tobacco crop is estimated at 232,300,000 lb. Acreage planted to tobacco for the 1951-52 crop is estimated at 298,000 acres, compared with 296,800 acres planted in 1950-51. Estimated yield per acre for 1951-52 is now 652 lb., compared with earlier forecasts of 795 lb. per acre. The 1950-51 yield is estimated at 783 lb. per acre.

Currently, flue-cured production in Rio Grande do Sul is estimated at 30,900,000 lb. Rio Grande do Sul's 1950-51 flue-cured production is estimated at 40,600,000 lb. The Santa Catarina flue-cured harvest is currently estimated at only 3,500,000 lb., compared with 4,400,000 lb. in 1950-51. Combined production of air-cured leaf in these two Brazilian states during 1951-52 is now estimated at 45,200,000 lb., or 38% below the previous year's output. Acreage planted to tobacco in these states this season were about equal to the 1950-51 acreage; however, as a result of unfavourable growing conditions, yields per acre are reported lower. Leaf production in Bahia during the 1951-52 season is expected to be 33,100,000 lb. Minas Gerais's production estimate remains the same as earlier forecasts of 37,500,000 lb.

BRAZILIAN PRODUCTION OF TOBACCO
1939-1950

Year	Cultivated Area (hectares)	Total Quantity (metric tons)
1939	92,887	95,998
1940	96,419	94,768
1941	96,313	95,337
1942	96,214	92,951
1943	103,137	91,583
1944	114,769	104,363
1945	143,565	113,449
1946	136,495	119,225
1947	134,211	110,889
1948	143,877	117,627
1949	145,447	114,504
1950 (provisional) ..	120,162	103,705
1951 (provisional) ..	120,648	86,697

(Figures 1939-1949 inclusive supplied by the Brazilian Government Trade Bureau, London; those for 1950 and 1951 from the U.S.D.A.'s 'Foreign Crops and Markets'.)



Tobacco is known as the poor man's crop in Bahia, Brazil; two or three acres suffice to support a family

Production in India

India occupies an important place amongst the tobacco-producing countries of the world, and now ranks as the third largest producer. Three countries, the United States, China and the Indian Union account for over half of the world's total acreage. In 1948, for example, the area under tobacco in these three countries was as follows:—U.S.A., 1,554,000 acres; China, 1,529,000 acres; India, 774,000 acres. In the United States the area under cultivation was 2,000,000 acres in 1946. Since then, however, the dollar shortage and inability of foreign markets to buy has necessitated a marked contraction, and by 1948 the total dropped to one and a half million.

Production of tobacco

In India, on the other hand, the acreage has been fairly well maintained, and in 1950 the total area under tobacco cultivation was 774,000 acres with an estimated output of 540,000,000 lb. Madras is by far the most important producing State, accounting for nearly 50% of the area in the country. Bombay, U.P. and Bihar are next in importance in that order and together cover 36% of the total acreage in the country.

The two tobacco species, *i.e. Nicotiana Rustica* and *Nicotiana Tabacum* are cultivated. The former is less important, commercially.

The other species, *i.e. Nicotiana Tabacum*, is distributed throughout the country and occupies a much greater area.

Virginia tobacco

The production of Virginia tobacco is concentrated mainly in Madras State. The acreage in Madras increased from 110,000 acres in 1944-45 to 159,000 acres in 1949-50. A little over 95% of the Virginia tobacco is flue-cured and the balance cured in the sun. The production of flue-cured Virginia tobacco in 1949-50 was estimated at a little over 84,000,000 lb., and that of sun-cured Virginia at about 800,000 lb.

White Burley

White Burley tobacco is also cultivated in Madras; a large proportion is exported. The area under this variety is estimated at about 1,055 acres.

Exports

The bulk of the tobacco is consumed within the country. The quantity of unmanufactured tobacco exported is not inconsiderable and amounted to 89,000,000 lb. during 1950. While the United Kingdom still remains the chief market, the main expansion in exports in 1950 has been to markets outside the Commonwealth.

TOBACCO ROUND THE WORLD

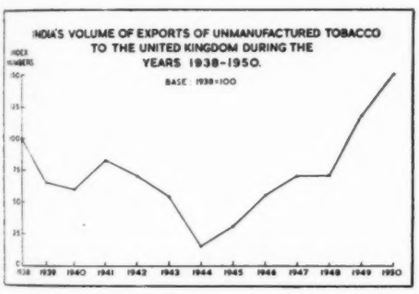
A field of Virginia tobacco grown in Madras

The Seaborne Trade Statistics clearly indicate that there has been a considerable increase in exports of tobacco from India during recent years:—

Year	Quantity in million lb.	Value in £ million	Average value per lb. s.	d.
1945-46 ..	23.77	1.7	1	5¾
1946-47 ..	75.38	5.3	1	5¼
1947-48 ..	52.72	4.8	1	9
1948-49 ..	55.83	6.0	2	2¾
1949-50 ..	75.62	8.0	2	2

The United Kingdom ranks first as a market for Indian tobacco and 71% of India's total exports in 1949-50 went to the United Kingdom.

Indian flue-cured Virginia tobacco has gained a specific use in the tobacco manufacturing industry in the United Kingdom and other continental countries. It is well known for its bright colour and neutral flavour and these characteristics enable it to be used in blending without impairing the colour of blended tobacco or its aroma.


INDIA'S VOLUME OF EXPORTS OF UNMANUFACTURED TOBACCO TO THE UNITED KINGDOM DURING THE YEARS 1938-1950.
BASE 1938=100
1938 1939 1940 1941 1942 1943 1944 1945 1946 1947 1948 1949 1950

As far as Europe is concerned, Belgium and Holland are the two most important countries where Indian tobacco has been imported for quite a long time mostly on consignment basis. Of late, Indian flue-cured Virginia is being freely used for blending purposes in cigarette manufacturing houses in Sweden. All grades of Indian tobacco are being used for this purpose.

The Indian Central Tobacco Committee

The Government of India constituted the Indian Central Tobacco Committee in November 1945 to assist in the improvement, development and marketing of tobacco and its products. It has already established a Central Tobacco Research Institute at Raishmundry for fundamental and applied research work on all types of tobacco and experimental stations for research on specific types of tobacco like Bidi (Bombay), cigar and cheroots (Madras), hookah and chewing tobacco (Bihar).

Among the functions of the Central Committee are the encouragement of the adoption of improved measures for the marketing of tobacco, including the setting up and adoption of grade standards for tobacco and its products and assisting in the development of a sound export trade in tobacco and its products.

Quality control measures

The compulsory system of grading of Indian tobacco came into operation in June 1945 when the Government of India prohibited the exports of unmanufactured tobacco of four varieties, *viz.*, flue-cured, Virginia sun-cured, sun-cured Natu (country) and Motihari to any country unless it was graded and marked in accordance with tobacco grading and marketing rules, 1937, and was certified to this effect by the Agricultural Marketing Adviser to the Government of India or an officer authorised by him for the purpose.

There was thus a good demand for Indian tobacco from the U.K. and several other foreign markets from where substantial orders for the supply of Indian tobacco were received on the basis of Agmark Grades.

Tobacco Officer in London

In order to promote the sale of Indian tobacco in the U.K. and Europe, the Government of India appointed a tobacco sales officer in London in 1948.

Cigars from Jamaica

Although tobacco is probably the oldest industry in Jamaica, dating from the time of the Arawak Indians, it was only in 1944 that the income from tobacco exports (virtually all cigar exports) reached the six-figure mark. Since the war, however, with the closing of the dollar market to Britain, Jamaica has been relied upon to supply the bulk of U.K. cigar imports.

Jamaica's tobacco industry employs around 12,000 workers, growing and manufacturing cigars and also a cheap twist universally smoked by the native population. No cigarette tobacco has been successfully grown commercially on the island so far, nor is the cigar wrapper type tobacco (shade grown) cultivated, and imports of wrapper leaf have to be made from Havana and Florida.

In 1947, 26,000,000 cigars valued at £800,000 were exported to the U.K., which takes the major portion of Jamaica's output; this was a peak year. The high U.K. import duty restricts expansion of the cigar industry, although export of leaf tobacco for manufacture in the U.K. is slowly increasing.

Below are a few figures showing the amount and value of cigar exports before and after the war, also the amounts taken by the principal importing countries:

EXPORTS OF CIGARS FROM JAMAICA PRE-WAR AND POST-WAR

	lb.	£
1938	32,272	17,028
1949	200,550	385,897
1950	240,328	563,794

JAMAICA CIGAR EXPORT DESTINATIONS 1949 AND 1950
(To nearest 1,000 lb.)

	1949	1950
U.K.	147	185
Panama	10	14
Australia	11	8
Bahamas	9	8
Bermuda	5	5
British South Africa	4	4
Others	—	16

TOBACCO ROUND THE WORLD

The Industry in Australia

Tobacco growing years ago promised to occupy an important place among agricultural industries of Australia, and as early as 1888-89 the tobacco area amounted to 6,641 acres, of which 4,833 were in New South Wales, 1,685 in Victoria and 123 in Queensland. This promise, however, was not fulfilled, and after numerous fluctuations, in the course of which the Victorian area rose in 1895 to over 2,000 acres, and that in Queensland to over 1,000 acres, the total area declined considerably.

During the last war it was hoped that the tobacco growing industry would expand; the acreage increased slightly during the first three war years, but it has decreased considerably between 1941-42 and 1949-50. Since then it has increased and the 1951-52 production is preliminarily estimated at 54% above the 1950-51 harvest of 4,200,000 lb. from 6,625 acres.

Australian tobacco factories use about 30,000,000 lb. of leaf annually, so it can be seen that domestic production could be considerably increased to the benefit of the Commonwealth, particularly as the bulk of tobacco imports are from the United States.

AUSTRALIAN TOBACCO: AREA AND PRODUCTION

	Acreage	Production (dried leaf in lb.)
Average 1929-30 to 1938-39 ..	11,260	5,343,000
1939-40	8,288	4,957,000
1940-41	8,548	5,476,000
1941-42	8,820	7,040,000
1942-43	7,169	4,969,000
1943-44	6,616	4,633,000
1944-45	4,775	2,844,000
1945-46	3,971	2,505,000
1946-47	4,492	3,994,000
1947-48	3,843	2,484,000
1948-49	3,720	3,416,000
1949-50	4,584	4,200,000
1950-51	6,625	4,200,000
1951-52 (est.) ..	7,678	6,500,000

Source: Library, Australia House, London, and *Foreign Crops and Markets*.

Greece Trying to Reach Pre-War Export Position

The tobacco cultivated in Greece at the present time is principally of the Turkish varieties and the areas of production are east Macedonia and Thrace, central and western Macedonia, Thessaly and Aetoloakarnania.

Figures supplied by the Commercial Counsellor of the Royal Greek Embassy in London indicate that production has not altered greatly since the war. The average annual production from 1935-39 was 60,150,000 kg., while in 1950 and 1951 production was 58,100,000 kg. and 62,700,000 kg., respectively. Similarly, the average annual acreage during those same pre-war years was 230,500 and in 1950 and 1951, 253,800 and 233,000, respectively.

After the war exports decreased considerably, although the latest figures show signs of a slight increase:

EXPORTS PRE-WAR AND POST-WAR

Year	1,000 Kg.
1937	43,840
1938	48,900
1949	28,700
1950	26,370
1951	31,040

Before the war Greece had little difficulty in exporting her surplus tobaccos to Germany. Since the war, however, Germany has been flooded with American cigarettes and the demand for the high-quality Greek product has fallen considerably (WORLD CROPS, June 1951, 3 (6), p. 212).

In order to encourage the production of superior-quality leaf the Greek grower now receives a subsidy based on a percentage of the selling price, which increases with its value; the subsidy starts from a minimum of 25% for inferior leaf, rising to a maximum of 50% for the best quality.

A premium on tobacco exports amounts to 12% for all destinations. Special premiums on exports to the U.K. and Egypt, which were operating until recently, have now been discontinued.

The Four Principal Producing Areas of Yugoslavia

Tobacco is cultivated in the south and south-west of the Federal Republic of Yugoslavia. The tobaccos of Macedonia and Herzogovina are well-known and appreciated in Europe for their high quality.

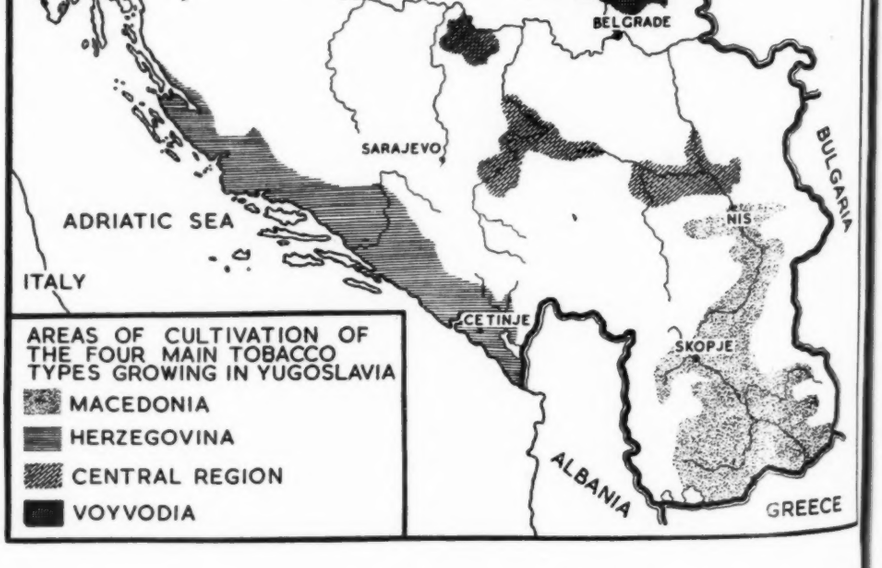
As the production of fine tobacco is important to the country economically, considerable attention is paid to the improvement of this branch of agriculture, and there is a Scientific Institute of Tobacco, tobacco research stations and field trials in the different areas of cultivation, as well as a school for tobacco specialists which has recently been founded.

Production areas

There are four large areas of production in which the different tobaccos possess typical characteristics and qualities. In Macedonia and south Serbia two specific types are cultivated, known under the names of 'Yaka' and 'Prilep,' and are grown in a Mediterranean climate. The leaf is small, yellow-gold in colour, aromatic, oily and of fine structure.

In Herzogovina, Dalmatia, Montenegro and Istria the types 'Herzogovina' and 'Istria' are grown. The Herzogovina type has a strong golden colour and elasticity of tissue which enables the cutting of long shreds.

In central Serbia and Bosnia, tobaccos named 'Prossotchan' and 'Bainovac' are



TOBACCO ROUND THE WORLD

Classification of American Tobaccos

Macedonia-type tobacco of Yugoslavia being arranged for open air-curing; note the rolled up cloth for providing shade

grown. These tobaccos are produced under less favourable climatic conditions and have medium and large leaves; they are orange coloured, less aromatic and mainly used as material for blending.

In the Voyvodia area tobacco for the manufacture of cigars, pipe tobacco, chewing tobacco and snuff is grown. The three basic types are called 'La Rose De Seguedine,' 'Debrecine' and 'Tissa,' having very heavy leaves of elastic-like tissue and giving a heavy and even yield. They are cultivated on the fertile chernozem soils under east-continental climatic conditions.

Grading and curing

Tobacco is graded according to variety, area of production and moisture content. All centres of production have curing barns so that the tobacco can be treated regardless of weather conditions.

Many types of cigarettes are manufactured in Yugoslavia from the four producing areas, either pure or blended. A certain amount of nicotine is also produced for agricultural and pharmaceutical purposes.

(From information supplied by the Information Department of the Yugoslavian Embassy, London.)

The great bulk of the world's tobacco supply is derived from *Nicotiana tabacum*, the Virginian tobacco and a plant indigenous to America. Contrary to popular opinion, this is not the species that the early English colonists discovered growing in Indian villages in Virginia during the 16th century.

Most of the tobacco cultivated by North American Indians was of the species *N. rustica*, which is stronger and less agreeable than *N. tabacum;* the latter is the tobacco of commerce in America and most other producing countries of the world and is believed to have originated in Brazil.

In the U.S.A. production of tobacco is highly localised and each of the 26 officially recognised types for classification is produced in a relatively small area with distinctive soil and climate characteristics. These 26 types may be grouped into six classes as follows:

Cigarette, smoking and chewing types:
- Flue-cured (four types)
- Fire-cured (four types)
- Air-cured (five types)

Cigar types:
- Cigar filler (five types)
- Cigar binder (six types)
- Cigar wrapper (two types)

Flue-cured tobacco is produced in Virginia, North Carolina, South Carolina, Georgia, Florida and, to a small extent, Alabama. Nearly all flue-cured tobacco is primed, *i.e.* the leaves are removed as they reach maturity, beginning with those at the bottom.

Air-cured tobacco is produced in all tobacco-growing states and is subdivided into light and dark types, the latter containing no cigarette grades.

Fire-cured tobacco is produced in Virginia, Kentucky and Tennessee.

Cigar types are classified according to their principal use, *i.e.* filler, binder and wrapper types.

Filler types are stalk cut, air-cured and usually stemmed before entering the manufacturing process. The most important filler type is Pennsylvania Seedleaf, type 41.

Binder types include Connecticut Broadleaf, Connecticut Havana Seed, New York and Pennsylvania Havana Seed, Southern and Northern Wisconsin, and Georgia and Florida Sun-grown.

Wrapper types include two types of shade-grown tobacco, Connecticut Valley Shade-grown and Georgia and Florida Shade-grown.

Shade-grown tobacco is sorted into 10 to 15 grades, packed and pressed into bales averaging 165 lb. weight each.

U.S.A. tobacco production for the past 12 years is shown below:

U.S.A. Tobacco

	Acreage Harvested 1,000 of acres	Production million lb.
1940	1,410	1,460
1941	1,307	1,262
1942	1,377	1,408
1943	1,458	1,406
1944	1,751	1,955
1945	1,823	1,994
1946	1,963	2,322
1947	1,853	2,110
1948	1,555	1,981
1949	1,631	1,972
1950	1,594	2,036
1951 (estimated) ..	1,727	2,282

(Compiled from 'American Tobacco Types, Uses and Markets,' Circular No. 249, U.S. Department of Agriculture.)

Stimulated Production in Cyprus Since the War

In recent years the demand for Cyprus-grown yellow-leaf and fumigated tobaccos for export has been greater than ever before and this increasing demand has stimulated production. The area licensed for tobacco cultivation in 1950, for instance, showed an increase of 25% on the preceding year.

In Cyprus the cultivation of tobacco is prohibited save under licence, the minimum area for which a licence is granted being two donums. During 1950 (the latest year for which figures are available) 2,652 licences were issued.

The amount of tobacco exported during 1950 was nearly double the figure for 1949, 531,469 okes compared with 267,560 okes, and the value of exports was more than three times that of the previous year, £120,901 compared with £55,868. About three times as much yellow-leaf is grown than fumigated tobacco.

The two main markets for yellow-leaf are the United Kingdom and Egypt; the United Kingdom and United States import practically all the exported fumigated leaf.

Cyprus—Production Figures

Year	Area cultivated (donums)	Production (okes)			Total (okes)
		Yellow-leaf	Fumigated	Virginia	
1950	10,048	459,543	177,112	2,912	639,567
1949	7,570	357,683	69,117	11,070	437,870
	+ 2,478	+ 101,860	+ 107,995	— 8,158	+ 201,697

1 oke = 2¾ lb. 1 donum = ⅝ acre. + = Increase. — = Decrease.

(From the Annual Report of the Tobacco Officer for 1950, Department of Agriculture, Cyprus.)

Photos: P. 237, South Africa House, London; p. 238, Ewing Galloway, New York; p. 239, India House, London, p. 241, Yugoslav Embassy, London.

Research in the Field of Tobacco Cultivation and Processing

JOHN GRINDROD, B.A. (Com.)

At the World Tobacco Congress, held at Amsterdam in September 1951, most countries interested in growing and processing tobacco sent in reports on tobacco research. These were studied, and upon them and the general report for the Natural Science section of the Congress by Mons. P. Gisquet, Director of the Institut Experimental du Tabac de Bergerac, Bergerac, France, this article is based. It provides a general review of the position.

BECAUSE tobacco can be grown in most parts of the world and in a variety of soils and climates, local problems usually become the focal points for research.

Soil requirements

The tobacco plant grows in a variety of soils. Clay soils produce tobacco which is dark brown or reddish when cured. Bright and yellow tobaccos are grown on sandy soils. There has been a good deal of investigation into the suitability of soils for different varieties. In some countries special services are maintained to deal with soil analyses and to give advice on manuring for local conditions. In France, the action of a manure has been studied over a period, during which the stages of development were recorded.

Deficiency diseases

The influence of acidity and mineral elements has been recorded in some countries. Deficiency diseases, correlating the lack of trace elements to the condition of the plants, have been studied in the U.S.A. and Canada, while work on the effect of boron in the German Federal Republic showed that 2 to 3 kg. of borate of soda per hectare was the normal requisite, but that its effect varied with the type of soil. Boron produces lighter colour, improves burning and makes the ashes whiter. On the other hand, chlorine has an unfavourable influence on burning quality.

Tobacco nurseries

A sheltered spot, with a southern aspect in the northern hemisphere, is usually selected for the nursery. In some cases, in order to prevent virus diseases such as mosaic, or vegetal parasites, soils to be used in seed beds must be sterilised. Steam sterilisation against mosaic has been used in Switzerland and South Africa, while against *Thielavia basicola*, the most widely spread of the mushroom parasites, formaldehyde has been used in Germany and South Africa, though the steam process seems the more efficient. In France, a simple and cheap method of sterilisation by steam on heated sheet metal has been used.

Crop rotation is commonly practised to control disease. In Switzerland and Canada the same land only carries tobacco every third or fourth year; in Germany the incidence of mosaic has been reduced by avoiding the planting of tobacco twice in succession or after such crops as potatoes, beetroot, etc.

Climate

Climate has for long been recognised as a determining factor, especially as regards nicotine content. Hot dry summers tend to produce a higher nicotine content than cool rainy ones.

Because certain types of tobacco have come into popular demand in recent years, and particularly the increased demand for cigarettes, certain countries have acclimatised foreign varieties to their own local conditions. For instance, many countries, including South Africa, Canada, Japan, Thailand, Spain, etc., have produced local varieties of Virginia Bright; Switzerland, Spain, Japan, Canada and other countries have grown Burley types; and Oriental tobaccos have been acclimatised to South Africa and so on.

Diseases and pests

The tobacco plant is subject to attack by a number of vegetal and animal parasites and by bacterial and virus diseases.

Of the vegetal parasites, *Thielavia basicola* has been controlled by sterilisation of the seed beds with steam and formaldehyde (as already mentioned), and in the open fields by crop rotation and the cultivation of resistant varieties. 'Powdery mildew' (*Erysiphe cichoracearum*), has been treated by airing the base of the plant and, in some cases, by the thinning-out of the lower leaves. Chemicals used include arathane, tested in South Africa, and lithium salts, which are added to the soil in Italy. To get over 'black shank' or *Phytophtora nicotianae* in tropical countries and elsewhere, the resistant varieties Oxford 1, Dixie Bright 100 and 102 have been produced. 'Blue mold,' has been treated by fumigation with paradichlorobenzene steam, spraying or dusting with ferric carbonate. Resistant strains have also been cultivated.

Among bacterial diseases, Wild Fire (*Bacterium tabacum* or *Pseudomonas tabaci*) was at one time very destructive. Recently, however, reports from a number of countries including Spain, France, Switzerland, Germany, etc., show it seldom reached the epidemic stage, thanks to preventative measures. These have included spraying with copper solution, disinfecting seeds with formaldehyde, silver nitrate and mercuric chloride. In the United States strains proof against the disease have been obtained by crossing *Nicotiana tabacum* with *N. longiflora*. Similarly, varieties proof against 'bacterial wilt' (*Bacterium solanacearum*) have been produced in the southern U.S., where it is known as 'Granville wilt.' These are Oxford 26, Dixie Bright 100 and 102.

Of the virus diseases, mosaic has been the subject of research in almost all countries. Various methods of control have been adopted, including sterilisation of the seed beds, crop rotation, elimination of infected plants and personal precautions. In addition much work has been done in various countries with the purpose of obtaining mosaic resistant varieties, either by hybridisation with *N. tabacum* var., *Ambalema* or by interspecific hybridisation with *N. glutinosa*. The former methods have been used in Spain and South Africa, and descendants, sufficiently resistant for practical purposes have been obtained. In the latter method the main variety *N. tabacum* has been changed only enough to give it resistant properties.

Other research work has been carried out on 'curly dwarf,' or Kroepoek, and 'chokeweed,' but these virus diseases are not so widespread.

The 55,000 million gallon Hunyani Poort dam, Southern Rhodesia, which, due to a record rainfall in January, was filled in February, although it was expected to take two or three years to fill. The dam is to be connected up to Salisbury's water supply. It also holds out potentialities as a valuable supply of irrigation water for, among others, tobacco growers

Animal pests

Various methods have been adopted in waging war against animal parasites. In some cases this is done by cultivation, using a machine with a rotary movement by which such parasites as wireworms can be destroyed in the upper layers of the soil; but treatment usually takes the form of applying insecticides chiefly of the DDT or BHC type.

For wireworms (*Agriotes lineatus*, *A. obscuras*, *etc.*) products containing DDT have been used in Switzerland and France; in the latter country for watering plants after pricking out. BHC has been used at the rate of 5 kg. pure per ha. in the soil before planting. It has been found that if it is used for watering plants it causes damage if it comes into contact with the leaves. BHC, however, has not always been successful in treating wireworm and white grub (*Melolonthids*) and in some cases it has affected the flavour of the tobacco.

BHC has not proved effective against 'cut worm' (*Euxoa*, *Agrostis*) in France, but DDT has reduced the damage. From many countries in which this pest was reported, the use of synthetic insecticides was recommended. In Canada bran bait, poisoned by Paris-green, has been used in the soil before planting; bait containing fluosilicate of soda has been used in South Africa.

Treatments against other insect pests reported have included DDT or lead arsenate for 'hornworm' (*Protoparce quinquemaculata*), DDT rotenone, parathion, etc., for 'greenflies' (*Myzus persicae*), DDT for caterpillars (*Phtorimaea operculella*) and poisoned bait for locusts and crickets.

Nematodes have caused much trouble in come countries and have been countered by various methods. One of these has been by concentrating on the growth of Burley and yellow types of tobacco, which are more resistant, and by taking care not to let tobacco follow maize or soya beans in the rotation. Soil fumigants have also been used.

Tobacco is liable to be attacked by parasites while stored in the warehouse after harvesting. Of these the more important are *Lasioderma serricorne* and *Ephestia elutella*. To overcome these, methods of disinfecting the warehouse are used, but care must be taken that the insecticides employed do not damage or flavour the tobacco itself. The use of pyrethrum in an oil of low viscosity and high volatility has been recommended for warehouses in South Africa, while methyl bromide has been recommended to treat the tobacco. In Germany ethylene oxide and T-gas are used, while in Spain warehouses are disinfected with hydrocyanic acid.

Mons. P. Gisquet says that incontestable progress has been made on pathology of tobacco. He recommends continued investigation on the lines of hybridisation to perfect types resistant to disease. He acclaims the progress made possible by the use of synthetic products and suggests attempts to perfect these measures of control, either by using new products or by better use of the products already known.

Plant improvement

Much research also has been done on improving plants by selection, acclimatisation, hybridisation and mutation. The tobacco plant is very fertile and lends itself readily to cross-breeding.

By selection, homozygous descendants have been developed which give better commercial and industrial results.

It is, however, to hybridisation between varieties that much of the improvement in tobacco is due, both as regards yield and quality. As an example mention might be made of the efforts in France to develop a variety for cigar wrappers suitable to French conditions, where Sumatra and Java types have been cross-bred with local varieties. Spain also has cross-fertilised local varieties with American and Central European types, while most of the tobacco cultivated in Switzerland comes from a hybrid of white Burley and Amersfoorter.

Research has also been undertaken in many countries in the study of mutations, both under natural conditions and in experimental work, but much still remains to be done in exploring the cytology of tobacco.

Indefinite results have been reported from the use of synthetic hormones in the cultivation of tobacco in the U.S.A., South Africa, Italy, Spain, Switzerland and France. They were used mainly to quicken seed germination, to promote the rooting of seedlings and to prevent the formation of auxiliary buds after 'topping.'

Apart from investigations into the effect of soils and manures on the growth of the tobacco plant, research has also been conducted into the chemistry of the plant itself, both during the processes of drying and fermentation after harvesting and into the chemical composition of the industrial raw material.

In summing up his report on the contributions made by the various countries in the field of tobacco research, undertaken either at experimental stations or institutes or by individual investigators, Mons. Gisquet emphasised the desirability of collaboration between these various centres and the creation of a permanent body for the international exchange of scientific data on the subject.

Photo : J. L. Hopkins, B.Sc., A.R.S.M.

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The Egyptian Cotton Industry

Part II — Breeding and Testing

C. H. BROWN, B.Sc.

Late of the Egyptian Ministry of Agriculture

The high reputation for quality which Egyptian cotton enjoys today is largely the result of the care and attention which has been devoted to the improvement of the crop by breeding and selection. The following article describes the selection work in Egypt, including the elaborate provision for the commercial testing and valuation of new types of cotton evolved as the result of breeding work. Much of the work was carried out, and many of the types of cotton were evolved, under the direction of the writer of the article.

A BREEDER'S first instinct on contact with a crop which has never been worked on is to purify some strains from the diverse types which he is bound to find. Early work in Egypt was no exception to this rule. The strains isolated by Dr. W. L. Balls between 1904 and 1914 were not kept up, and the late M. A. Bailey and T. Trought in 1920, had practically to begin again from scratch. Purified forms of both Ashmuni and Sakel were bred and maintained by them and off-type field selections made of several of the varied forms which the crops of these days showed. The single plant selections, from which Giza 3 and Giza 7 were bred were both made in a field of Ashmuni in 1920.

When I took over this work in 1925, Bailey and Trought were both leaving Egypt; the merits of the strain we named Giza 7 was one of the first things to attract my attention, and we started propagation of it immediately. This strain became a huge success, reaching its peak acreage in the late 30's, but the main point of interest is that it was a medium-long staple cotton, generally acceptable as a substitute for Sakel, when grown in the North Delta. Nevertheless, it came from an Ashmuni field.

This type and Giza 3 were almost certainly natural hybrids; the mother type from which they were isolated being presumed as one of the parents. It would be almost impossible to find such off-types today. And so it is that as his main types get more and more purified, the breeder quickly learns that his emphasis must be shifted. The continuity of any one variety depends on its purity, but the future of a cotton type depends on preserving within it the maximum degree of variability, since it is in this way that progress can be ensured for the future. The best way to conserve variability appears to be to make a wide range of crosses between different strains, including any imported varieties having characters which could be incorporated. Selection can then be made for extreme values in any desirable direction, an aspect of our work in Egypt which I shall refer to again. The programme of crossing work in Egypt, which was later to develop with such success, started in 1923 with a cross between the then main varieties, Ashmuni and Sakel.

Sakellarides cotton

It has always been a criticism of Egyptian cotton that varieties came and went too fast. Before breeding came under the government aegis a large number of private individuals had taken an interest in it. In the early years of this century many of these were Greek residents in Egypt, the names of Sakellarides and Parachimonas being the best known. They were, of course, taking advantage of existing natural variability, as Bailey and Trought did in 1920. Sakellarides, selecting the type which came to bear his name, appears to to have hit on a genetic combination containing a particularly high proportion of Sea Island blood, as shown both by its high quality and its susceptibility to Fusarium wilt. The Sea Island strain had certainly been among the numerous introductions of the 19th century, and it must have crossed and re-crossed many times, as any cotton would in those mixed days. The special point of the Sakel selection was that it represents a new high level of Egyptian quality from which the crop has never looked back.

Degeneration of certain varieties

But the welter of natural crossing which produced these types also ruined them. The preservation of the purity of a variety on a large scale requires considerable organisation, and no such organisation then existed. The need for replacing a variety was due therefore almost entirely to its having degenerated. With the introduction of modern breeding methods, however, this is no longer the case, and it is now possible not only to maintain the quality and the purity of a new type, but even to

Hand-hoeing young plants in an Egyptian cotton field

improve on it by careful reselection; today the replacement of a variety by a new one means that genuine progress has been achieved. The government seed organisation came into existence in time to save Sakel, and the replacement of Sakel by Giza 7, and later of Giza 7 by Karnak, as the main quality types, both represented genuine economic improvements.

Purity of strains

Purity is a relative term and it is interesting on analysis of an apparently pure type to discover the small genetic differences that remain. The present St. Vincent Superfine Sea Island stock is claimed to be unamenable to any further improvement by selection; if this is so, it may be perhaps the only 100% pure cotton type grown anywhere in the world on a commercial scale. The present Egyptian varieties are relatively pure, but I do not recall a single one which has not shown some genetic variation on careful test. What is wanted for an established variety is a system which ensures the preservation of a reasonable degree of commercial purity but allows advantage to be taken of residual differences for reselection.

The Giza system of selection

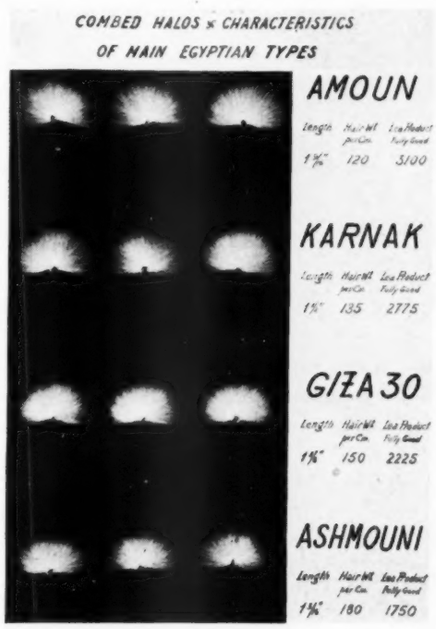
This system follows cycles of about four years each, at the end of which the existing nucleus is replaced by a fresh one of single-plant origin which should be, at worst, identical with the parent bulk it replaces and, preferably, an improvement. The testing of small differences to detect this improvement is the tricky part of the work. Starting from ten random single plants, all apparently typical, these are bulked up and at the same time tested in replicated trials. After two years' test of the ten, the parent bulk being naturally used as the control, these are reduced to the best five, which are then tested in several localities to make sure of the final selection of one. This finally selected one became the new nucleus, and from it ten single plant lines are again isolated to start a fresh cycle.

If a variety retains a fair amount of variability, quite startling improvements can be effected in a few such cycles. The nucleus seed so obtained is of course the central stock for the main commercial bulk of the variety. The control of the latter and its replenishment from the nucleus is much more difficult in a country like Egypt with many small individual holdings, each free to choose their own seed, than in the case of one like the Sudan, where seed production and supply is planned and carried out by a central controlling body.

Some examples

It seems only fair to admit that in all breeding work there must be a certain amount of luck. Genetic stability may be reached early and easily, or with great difficulty. The Karnak variety is an example of the former. It proved so outstandingly interesting in the late 30's that its propagation was rushed from F5 stock, the first bulk being in 1937.

It was a gamble which came off, because Karnak showed from the beginning a high degree of genetic stability. Its response to reselection has been slight, while a field of commercial Karnak today, 15 years after its initial propagation, looks as pure as it ever was.


COMBED HALOS & CHARACTERISTICS
OF MAIN EGYPTIAN TYPES
AMOUN
Length Hair Wt per Cm. Lea Product Fully Good
1 3/16" 120 5100
KARNAK
Length Hair Wt per Cm. Lea Product Fully Good
1 1/16" 135 2775
GIZA 30
Length Hair Wt per Cm. Lea Product Fully Good
1 1/16" 150 2225
ASHMOUNI
Length Hair Wt per Cm. Lea Product Fully Good
1 1/16" 180 1750

As examples of unexpected degrees of instability I may quote Giza 31 and Menufi. The former was a reselection in the early 1930's from the Giza 3 referred to above as originating in a single plant in 1920. Giza 31 was renamed because of a marked difference in earliness from the parent. Since then the type has continually responded to reselection, in spite of the yearly selfing which would have been expected to purify it, and individual lines are still showing differences, 30 years after its recorded history started. The Giza 31 of today, now having a commercial trial in the extreme south of Upper Egypt, is a most interesting cotton. It is both the earliest maturing variety and also the most resistant to extreme heat. As a result it consistently gives the highest yields in districts south of Assiut where Ashmuni suffers from the heat. Staple has been sacrificed to get these agricultural mixtures, and the cotton, though longer, is wastier and neppier than Ashmuni. Its lint resembles a long staple American Upland more closely than any other Egyptian type, and if its high yield enabled it to undersell Ashmuni it could enjoy a market among American types.

The original cross of Ashmuni and Sakel gave us Giza 12, which had a short commercial life under the name Wafeer and was crossed with Sakha 3 to give Giza 36, now called Menufi. Following about two years later than Karnak it was not bulked until the F6 generation; even then it was not as pure as Karnak, and it was not until after much reselection that a purified form was achieved in the late 40's. With this reselection went a considerable degree of quality improvement. From being originally a medium staple, Menufi has been pushed up until its quality closely approaches Karnak, while in yield and earliness it is far superior. The existing Menufi is, I believe, the most valuable commercial Egyptian type at present available and is likely to increase in popularity as it gets better known.

Sakha 3 referred to above as one parent of Menufi is also a most interesting cotton and perhaps the most important in the whole range of parents used. It was originally a Sakel selection which showed extremely high yarn strength, due apparently to the intrinsic strength of the fibre. This valuable character has proved very heritable and has now been enhanced by some recent crosses of Sakha 3 parentage. Karnak itself is Maarad x Sakha 3, the latter having added strength to Maarad, which was a Pima selection and shared the weakness of the Pima type.

A little while after Karnak and Menufi were launched, an excellent new medium staple type called Giza 30 was put on the market. Very light in colour, fairly short and fine yet with a particularly mature fibre, this cotton has been most successful and is now a large-scale commercial variety. Crossed with Sakha 3 it gave a cotton called Giza 44 which showed the high strength of Sakha 3 to an even more marked degree. For use as a high strength parent, Giza 44 is now the main cotton used in the Giza crossing programme. From the cross Giza 44 x Menufi we have bred Giza 59, the most promising high quality cotton at present under test, which is superior to Kamah in both yield and quality. It will be noted that this new cotton has Sakha 3 on both sides of its pedigree.

The present position

It is on this kind of multiple crossing programme that Giza is at present concentrating, the days when important new varieties could be obtained by straight

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selection of off-types from a commercial crop having now passed. The successful building up of extreme values from a crossing programme depends of course on achieving an additive effect from small genetic differences. It would be nice to work these effects out theoretically with a complete genetic analysis and if this were possible the results would naturally be predictable. But in practice no economic breeder can do this, and our method at Giza has been to cast our hybridisation net as far and wide as possible. Practically every desirable commercial variety and many strains, which were never commercial but which carry some interesting individual character, have been involved in the extensive crossing programme. Six to eight new crosses are at present made every year. At about the F4 or F5 stage a rough estimate is made of those which show promise, the less interesting ones being discarded and testing work concentrated on as many families as possible of the more successful crosses. Any new type which shows one desirable character to an extreme degree, but which has no general commercial merit, is embodied in the crossing programme as a new parent. In this way there have come to exist Giza strains showing earliness, boll-size, length, etc., superior to any existing commercial variety. This collection of parents may be called a museum of variability; I regard it as a most important collection essential for a breeding programme for a commercial crop, from which big things can be expected in the future.

Quality limits

A word may be said about the upper quality limits of Egyptian cotton. Sahel represented at the time it first appeared the high point in quality. The Karnak of today, although it has much better agricultural merits, is closely similar to the original Sakel in general quality, although from time to time strains have been produced which surpass it. Thus Giza 26, propagated as Malaki, was distinctly better than Karnak, having the extra length of Maarad though without its weakness. Malaki had a fair run of commercial success during the war years, when it was in demand for specialised military fabrics, but after the war it proved unable to compete agriculturally with Karnak, which by this time had achieved an immense, perhaps an unprecedented, popularity. Two later selections, Giza 39, called Amon, and Giza 45, also spun better than Karnak because of their extreme fineness, but again neither can compete with Karnak in yield. These types have, however, had some success in competing with Sea Island cottons and if the recently produced Giza 59 can, as appears likely, beat Karnak in yield as well as producing staple of this highly specialised type, it seems that a very big future should await it.

Breeding and testing organisation

It is easy to see that quite an elaborate field testing organisation is required to assess the agricultural merits in various districts both of the commercial varieties and the new strains produced each year by the breeding programme. This kind of field testing, however, is run nowadays on a well-established routine, of which only the details are varied to suit local conditions.

The Giza test mill

A spinning test mill was built at Giza, beside the Cotton Research Board Laboratory, in 1935. It was designed by Dr. W. L. Balls, with the late H. A. Hancock as the first director. Previously samples from new varieties had been sent in limited numbers to the Shirley Institute for spinning. The new mill was designed for the rapid testing of small samples; at present all chequer plot samples are spun from each of the districts where they are grown. This gives a much better picture than where only samples from one selected district are spun. In addition the whole of the pedigree reselections of established varieties and all new families from F3 onwards can be spun. This gives a valuable continuity of quality comparisons from which reliable deductions can be drawn. Thus, while Giza 59 is now making its commercial debut, five years' figures are already available of its spinning performance. In making tests, 60 grams is a large enough sample; the usual routine is to test two samples of this size and take the average. The lint is double carded instead of combed and the card is divided into two, and both small samples run through together.

Spinning conditions and values

Spinning is done on ring spindles to a standard count of 60's. Some criticism has been voiced of this and it has been suggested that this count is too low to give an adequate test for high quality cottons. I think this misses the point that the idea at Giza was to get comparable figures. Balls and Hancock satisfied themselves that at any count relative differences were preserved practically unchanged, and the choice of 60's was made as it was the highest count at which our lowest quality cotton, Ashmuni, could be included with the others. Below are given a series of figures for the average count x strength product for a number of types:

Ashmuni	1,800 (= 30 lb. break at 60's count)
Giza 7	2,400
Original Menufi ..	2,500
Existing Menufi ..	2,700
Karnak	2,800
Malaki and Giza 59	3,000
Amon and Giza 45	3,100

Other characters

Side by side with the yarn strength, from which the count x strength product is obtained measurements are also made of length and fineness. These were originally regarded as important because it was hoped to predict from them the resultant yarn strength without actual spinning. Other than these two simply measurable characters there are, however, residual differences in the intrinsic strength of the actual cellulose which make their contribution to the strength of the spun yarn. They seem, however, much more difficult to measure accurately. Various devices have been tried, *e.g.* Balls' Magazine Hair Tester, which broke individual fibres, to the Pressley Tester which breaks bundles of fibres, but none gives great satisfaction. The use of these measurement is only to predict yarn strength, and we found it easier to spin the cotton directly than to measure the component fibre characters It is this simplicity of getting the direct yarn values which appears to be the valuable contribution of the Giza Test Mill.

Conclusion

Finally, the rapidity and ease with which these simplified strength tests can be run off enables the system to be used for an additional purpose. Since the 1920's when the seed control system was first devised it was intended as a double-edged weapon. As well as the yearly introduction of fresh stocks of seed of ' nucleus ' origin, grown either on government farms or under contract, a system of examination of all seed intended for sowing was inaugurated to eliminate deteriorated lots of seed and refuse them certification. This was originally based on the only method available, a study of the seed characters; this has some validity but is always difficult to be too confident about. For the high quality varieties, however, it was found that the differences in lint strength between impure and pure lots was enough to enable us to approve or reject—on an actual spinning performance—lots of cotton submitted as destined for sowing. It was not possible to test Ashmuni by this method both because the differences on the lower strength scale would have been too small to be easily detectable and because more lots would have been involved than we could cope with.

Photo : P. 244, Egyptian Education Bureau, London.

(*Left*) **Water culture tanks for experimental work on nutrient requirements.** (*Right*) **Hand spraying outdoor plots with selective weedkiller**

INDUSTRY'S CONTRIBUTION TO AGRICULTURAL RESEARCH—VII

I.C.I. and Jealott's Hill Research Station

A. H. LEWIS, D.Sc.

Director, Jealott's Hill Research Station

The research work of Imperial Chemical Industries in the agricultural field is well known; on the agronomic side it is largely centred upon Jealott's Hill Research Station at Bracknell in Berkshire. Below we give an account of the many lines of work in progress there.

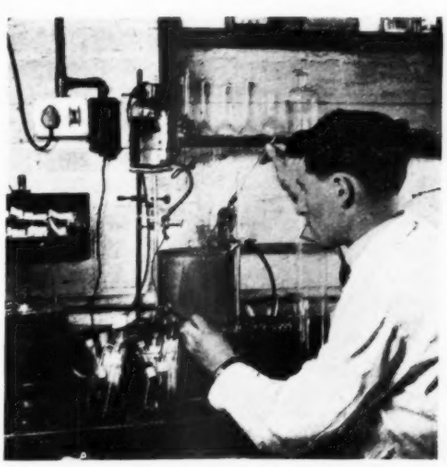
THE research done at Jealott's Hill is a part of I.C.I.'s activities in the agricultural field and a brief description of how Jealott's Hill fits into the I.C.I. organisation may help readers to get its functions into perspective.

I.C.I. operates about 80 factories in various parts of the U.K., making some 12,000 different products ranging from heavy chemicals, fertilisers, explosives, non-ferrous metals through paints, plastics, dyes, medicinal and veterinary chemicals, plant protection chemicals to slide fasteners. These products are made by 11 manufacturing units called divisions.

The needs of agriculture are manifold and all these divisions supply it with products of one sort or another. Because of this diversity I.C.I. includes a non-manufacturing unit, Central Agricultural Control, whose duties are to advise the main board on company policy relating to agriculture, to act as a link between the divisions at home and with I.C.I. companies overseas, and thus to co-ordinate I.C.I. effort to best advantage, to maintain contact with official and other outside bodies and to conduct agricultural research and development work.

History

Jealott's Hill Research Station came into being in 1928, following the purchase of a farm at Jealott's Hill, near Bracknell, Berks. At that date the main link between the chemical and agricultural industries was fertilisers. It was clear, however, that this was only a beginning and that agriculture required a wide range of chemical products. The great need for plant protection chemicals quickly became obvious and in 1935 a sister department, Hawthorndale, was set up on the Jealott's Hill estate to cover research into insecticides, fungicides, etc. The relation of Jealott's Hill and Hawthorndale with the Fernhurst Research Station of Plant Protection Ltd. was described by Dr. E. Holmes in the first article of this series. Complementary to the work of Jealott's Hill and Hawthorndale is that of Imperial Chemical (Pharmaceuticals) at Stamford Lodge, Cheshire, in the veterinary field.



Experimental work in the laboratory

Objectives

The principle on which all I.C.I. work in the agricultural field has been based has been simple—to study the needs of agriculture and to find how the chemical industry can meet these needs. The objectives of Jealott's Hill are therefore two-fold:

(1) To become a repository of knowledge on the use of chemical products in agriculture at home and overseas and to disseminate this knowledge.

(2) To undertake research to find what chemical products are needed in agriculture and to find how to use them most efficiently and, equally important, to undertake research likely to lead to increased agricultural prosperity, since

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the ability of agriculture to consume chemical products clearly depends on its prosperity.

The pattern of agriculture varies so widely and soil and climatic conditions are so diverse that it is essential to test any basic research finding under a variety of conditions, not only to discover how widely the basic finding holds good, but to ensure that any new product or process fits snugly into farming practice and is economically satisfactory. This follow-up is partly catered for by I.C.I. itself through C.A.C. Development Department at home and similar departments in overseas companies abroad and also by liaison with official and other bodies at home and overseas.

The fact that Jealott's Hill is part of a large chemical concern is of inestimable value. Not only does it afford a ready means of meeting our demands for new and novel chemicals, but it also places at our disposal the knowledge and experience of the many specialists throughout the company.

Jealott's Hill comprises 530 acres of farmland, plus laboratories and offices. The function of the farm is to provide facilities for field experiments; it is, in fact, our principal 'laboratory.' Each year about one-tenth of the land is under experiment; the remainder is farmed, as far as possible, on commercial lines, cropping and manuring being arranged to meet future experimental requirements.

The research staff is grouped into eight sections: field experiments, botany and plant physiology, soils and fertilisers, microbiology, animal nutrition, analytical, statistics and intelligence.

Grassland

The research now in progress at Jealott's Hill is a logical extension of that started in 1928. Particular attention has always been given to grassland. It was abundantly clear in 1928 that output from grassland was not a tithe of what it could be; grass was, indeed, the Cinderella of agriculture. The implications of the Cambridge work which showed that young, leafy grass was a high-quality feed, able to replace imported 'concentrates,' and of the Aberystwyth work on the interrelations of animal and sward were appreciated. Much effort was therefore devoted to detailed studies of grassland management and to conservation of herbage by ensiling and artificial drying. Owing to the dumping in this country of feeding stuffs at less than production costs overseas, consequent on world-wide economic depression, farmers were in no position to apply the findings of grassland research. When signs of war became ominous the position changed almost overnight. The struggle to put grass on the map was ended, to be replaced by a struggle to solve the many problems arising from the renewed enthusiasm of farmers.

Permanent grass and leys

The early work at Jealott's Hill, mainly on permanent grassland, led to the adoption of rotational grazing and to an appreciation of the value of 'early bite' and 'out of season' grass. Much attention was also given to the nutritional value of grassland herbage and to methods of conservation, particularly artificial drying and ensiling.

In recent years attention has turned more to a study of leys. Experiments have been undertaken on such matters as comparing the output of leys and permanent grass-

Pot test of nitrogenous fertilisers, using Italian ryegrass as the test crop

land, methods of establishing and managing leys and the use of special leys to extend the grazing season. In the last couple of years we have studied strip grazing or close-folding of dairy cattle using the electric fence. The results show that 20% greater output from a field of grass is generally attainable by close-folding; greater output means, in effect, less wastage. Further work is envisaged to study the factors which render soiled herbage unpalatable.

Irrigating grassland

Jealott's Hill is in an area of low rainfall and summer droughts are common. For some years we have been interested in the possibilities of irrigating grassland. The basic problem is to find when to apply water and how much to apply to get the best economic returns; even water is an expensive commodity. It is clear that occasional heavy watering is much more effective than frequent light watering, but more detailed study of soil/water/crop relationships is necessary.

Manuring grassland

There are two completely opposed schools of thought on the nitrogenous manuring of grassland. The Dutch are satisfied that for their conditions very heavy nitrogenous manuring of pastures containing virtually no clover is most productive and economic. In New Zealand the general consensus of opinion has been that nitrogenous fertilisers are unnecessary, as clovers can fix sufficient atmospheric nitrogen. For Britain the right answer is perhaps a compromise between these two extreme views.

There is surprisingly little information on the output of pastures of different clover contents, on the amounts of nitrogen fixed by clovers and on the fate of the nitrogen so fixed. At Jealott's Hill we are obtaining information on these points. It is clear that clovers can fix a large amount of nitrogen, but the growing season of clovers is far too short and the 'transfer' of fixed nitrogen from clovers to associated grasses may be much less than is generally supposed.

The ever-decreasing supply of imported animal feeding stuffs means that farmers have to pay even more attention to producing high-grade winter feed for livestock. Work at Jealott's Hill during and just after the war showed that the protein content of hay, silage and dried grass could be markedly increased by applying nitrogen fertilisers a week or two before cutting the grass. The idea of running a fertiliser distributor over long grass seemed at first revolutionary, but it was soon found that no damage was done and 'late top-dressing' is finding its way into practice. If the hay crop of the country, which amounts to over 5,000,000 tons, were 'late' top-dressed with 2 cwt. nitro-chalk per acre and its protein content thereby raised from below 8% to over 10%, the amount of protein imported could be reduced by 100,000 tons.

In recent years we have followed this up and results to date indicate that the maximum dose of nitrogen we have used, 6 cwt. nitro-chalk/acre/cut applied 'late' for five successive cuts, is probably not the economic maximum.

Grass drying and ensiling

Conserving young, highly nutritious grass by drying or ensiling is now established practice. Technically, ensiling is much more complex than drying and

Aerial view of Jealott's Hill Research Station in Berkshire

further effort to remove the difficulties which sometimes occur is worthwhile. Perhaps the outstanding problems are the difficulties in making good silage from very clovery material or from herbage which is wet and to preventing ingress of rain by providing suitable covers. These are being studied by I.C.I.

Animal nutrition

Complementary to the field experiments on grass outlined above is laboratory and small animal work on the nutritional value of herbage. This has in recent years followed two main lines. In the past it has been usual to employ empirical methods to determine ' fibre,' ' crude protein,' etc., in feeds; these fractions are not chemical entities, but are mixtures of varying composition. The aim is to replace them by objective determinations of specific chemical components. One aspect of this is a study of the ' non-protein ' fraction of herbage by chromatographic and other methods.

The second main line of work relates to upsets, such as bloat and lactation tetany, of nutritional origin. Bloat is essentially due to the presence of too much clover or lucerne in the sward. By suitable management of pastures it is possible to control the amount of clover in swards, but the selective grazing habits of cattle are such that bloat sometimes occurs on pastures which are not very clovery. It is therefore important to ascertain the root cause of bloat in order to find means of preventing or curing it.

Soil

Long-term experiments are in progress to study the effects of various rotations on soil fertility and crop production. ' Fertility ' is the sum of many factors. One to which we have given a lot of attention, not only at Jealott's Hill, but on farms scattered over the country, is the structure or aggregation of the ultimate soil particles. Soil in which the particles are ' cemented ' into small granules is at one and the same time permeable to excess water, yet retains in the granules or crumbs more moisture than a soil of poor structure and is well aerated. It is, in consequence, more easily cultivated and can be cultivated when structureless soil could not be touched; but, above all, it leads to a higher level of crop yields and a greater response to fertilisers.

Putting a soil down to grass for a number of years has a marked effect on soil structure. The practical aim of the work in hand is to find ' optimal ' rotations for different soils, *i.e.* the period of ley necessary to develop or maintain a good structure and the period permissible under cereals, roots, etc.

The mechanism whereby plant roots affect soil structure is complex and will take a lot of elucidating. Laboratory studies have afforded a clue to one aspect. Certain bacteria produce complex, gummy sugars which have the power of binding soil particles into crumbs. This led us to think that synthetic materials might be made with the same properties. In conjunction with the Billingham Division, many chemicals have been studied. Some have this property, but they are too expensive for general agricultural use.

Fertilisers

Apart from field experimental work on the usage of fertilisers, our interest in recent years has been mainly in phosphates. Of the phosphate fertilisers in use, water-soluble phosphates, such as superphosphate, are the most effective, but usually less than 20% of the P applied is absorbed by crops. The remainder is fixed in the soil in a form little or no more available than native P compounds in soil. The problem of increasing P efficiency can be attacked in two ways: to try to find means of preventing the soil fixing P so firmly or to find a P compound which is not readily fixed, but is highly available to crops. Work on these lines has been no more successful at Jealott's Hill than elsewhere.

The experience gained in attempting to find more efficient P fertilisers proved useful, however, when the shortage of sulphur became acute and supplies of sulphuric acid for the manufacturer of water-soluble phosphates were restricted. Billingham Division worked out a process based on reacting rock phosphate with nitric acid to give a nitrophosphate product. An extensive scheme of field trials, in which Rothamsted and the N.A.A.S. are participating, is now in hand.

Over the years search has continued for what is called a ' slow-acting ' nitrogen fertiliser. A few substances have been found with the necessary characteristics, but they are organic compounds too expensive for use in agriculture or even in horticulture.

Plant growth regulators

Work on these substances has proceeded at Jealott's Hill ever since the discovery by Kogl and Went of ' auxins.' The major practical outcome, selective weedkillers of the ' Methoxone ' (MCPA) type, is now well known. Their discovery was a logical outcome of experiments to study the effect of plant growth regulators on crops. One ambition, still unfulfilled, is to use this type of substance directly to increase crop yields.

One of the properties of MCPA and related compounds is causing cells to stretch or expand and thus to increase in size. This is one aspect of growth. The other aspect is cell division, and it was argued that substances which affected mitosis might also be selective in their effects. This proved to be the case and led to the discovery that isopropyl phenyl carbamate (IPC) is more lethal to graminaceous plants than to broad-leaved plants. IPC has, so far, proved an exasperating substance; its effects seem variable and relatively large amounts are needed to kill grassy weeds.

In co-operation with Plant Protection Ltd., a great deal of field work has been done at home and overseas on the use of 'Methoxone' and other compounds. Alongside this, laboratory work has followed two main lines:

(1) Search for new compounds which affect plant growth in one way or another.

This involves screening by a series of techniques large numbers of compounds synthesised in the I.C.I. divisions.

(2) Studies of the mode of action of ' Methoxone,' IPC, etc., including effects on mitosis, on respiration and changes in the carbohydrates in cells, the use of radioactive techniques to study the movement in plants of ' Methoxone ' analogues, and the interaction of ' Methoxone ' with monolayers of plant constituents.

Unconventional agriculture

Agricultural production is not sufficient to give the world's population an adequate diet and the population is increasing at a greater rate than food. This fact has led workers in U.S.A. to think of alternative methods of food production, in particular by mass culture of unicellular green algae in nutrient solutions. This is also being studied at Jealott's Hill. It seems clear that per unit area exposed to daylight, algae such as *Chlorella* can yield 50 or 100 times more food per acre than conventional agriculture. By varying the culture conditions the composition of the product can be altered. That produced from actively growing cultures contains about 50% crude protein and 25% lipoids. The protein appears to have a high food value.

It is difficult yet to assess economic possibilities, but it seems that capital cost of ' manufacturing ' plant would be high and that the cost of the product might be high relative to present costs of food. Whether we or our animals will ever eat algae will depend on the rate at which agricultural output can be increased.

A Record of the 1951 Plant Protection Conference

Those who were privileged to attend the international conference organised at Fernhurst in June of last year by Plant Protection Ltd., will retain vivid personal recollections of that eminently successful gathering.

Recently Plant Protection have published in volume form a report of the conference which includes all the papers delivered at it and a verbatim record of the discussions.

In this form it will be welcome, for not only does it afford those who were actually present an opportunity to refresh their memories concerning what took place, but it also records in permanent form much valuable information which came forward not only in the papers presented but also in the course of the discussions.

NEW BOOKS

Hevea: 30 Years of Research in the Far East

By M. J. Dijkman. Pp. xxii and 329 illustrated. University of Miami Press and Chronica Botanica, 1951. $6.

In writing this book Dr. Dijkman has performed a valuable service. Much of the earlier literature concerning Hevea, the tree upon which the plantation rubber industry is based, is difficult of access, while much of it is published in the Dutch language, with which most English-speaking scientists are unfamiliar. Consequently, a great deal of the fundamental research on the rubber tree is comparatively unknown.

The author has undertaken the task of summarising the existing literature reaching back for 30 years prior to 1941, when the research carried out by the Dutch in Indonesia came to a sudden halt as a result of the Japanese invasion. He has also included research work carried out by the British at the Rubber Research Institute in Malaya, the work of which was revived after the British re-occupation in 1945, as well as in Ceylon and in other parts of the world.

The book is written in 17 chapters, each one dealing with a different aspect of the production of rubber by the tree, *e.g.* the propagation of the tree, the pests and diseases which affect it, the improvement of rubber yields by selection and many other matters. The information given is very concisely worded, while the documentation is extensive and complete.

It is perhaps a pity that room could not have been found in the book for a review of the preparation of rubber from latex and the properties of latex and rubber, but this is perhaps too much to expect. As it is, the book is a monument to the industry and thoroughness of the writer: no one connected with the scientific study of the rubber tree in its botanical aspects could afford to be without it. It is profusely illustrated with a large number of figures and diagrams in the text, while there are a number of appendices noteworthy among which is one giving the characteristics of 14 of the most successful commercial clones of Hevea cultivated in the Far East.

Dr. Dijkman was for many years attached to the West Java Proef Station at Buitenzorg (now Bogor) where he published a number of papers on research connected with Hevea; since 1947 he has been assistant professor of applied tropical botany at the University of Miami in Florida.

H.T.

Advances in Agronomy

Vol. III. Edited by A. G. Norman. Pp. 361. Academic Press Inc., 1951. $7.80.

The review journal now has an important place in the literature of all sciences, and this third volume of Advances in Agronomy continues the editorial policy of providing reviews of advances in branches of science within the field of agronomy or of interest to agronomists.

Like most other review journals, this series tends to sit uneasily on the edges of two stools. One type of review is a detailed and briefly annotated account of the contents of bibliography. This is invaluable to the specialist if it is really complete and exhaustive, but it is usually almost useless to the agronomist who wants to brief himself outside his own small field. There are other reviews which are really essays on the present state of knowledge of a particular subject. These are of greatest interest to the non-specialist. Both types of review are in this volume; their function and appeal are quite different.

The long essay, *The Subsoil*, by E. Winters and R. W. Simonson, is one of the most valuable contributions to this volume. The author discusses the nature and properties of subsoils, and gives maps of the distribution of subsoil types, and profile diagrams.

Other interesting essays are: *Problems and Progress of Soil Conservation in the United States*, by H. J. Harper (with bibliography). *Irrigation, Agriculture and Soil Research in the United States*, by R. O. Parkes. *The Changing Pattern of Agriculture in England and Wales*, by J. A. McMillan.

Reviews in the form of a continuum of abstracts are *The Chemistry of Soil Potassium*, by R. F. Reitemeier, and *Chemical Treatment of Soil for Nematode Control*, by A. L. Taylor, in which there is no mention of the possibilities of control opened by the discovery of the eelworm hatching factor. *The Adaptability and Breeding of Suitable Grasses for the South Eastern States*, by G. W. Burton, contains an interesting discussion of the problems involved in evaluating grasses. *The Management of Alfalfa Meadows*, by C. J. Willard, is useful for its account of various cutting practices.

Taken all in all, this is probably the best volume yet published in this series.

JOHN L. HARPER

Phosphates in Agriculture

By Vincent Sauchelli. Pp. 176, illustrated. Davison Chemical Corporation, Baltimore-3, 1951. $2.5.

This book could more appropriately have been called a manual on *superphosphate* in agriculture, and if the reader makes that mental adjustment he will find it an excellent book indeed. Most other phosphatic fertilisers are treated briefly and even then the angle from which they are mainly discussed is that of comparison with superphosphate. However, this is no 'diehard' defence of the old-established process and product. The treatment is up-to-date; for example, one excellent chapter is devoted to superphosphate granulation (and granulation on the commercial scale is much more recent an innovation in the U.S. than in Britain) and a brief survey of radio-tracer P research is given. When one reaches the end there is the feeling that not much that could be said about superphosphate has been left out.

The genesis of the book should be explained. It has been published by one of America's largest superphosphate producers and is intended to serve as an informative manual for works and office staff, for salesmen and agents. The 'literary' level is popular rather than scientific and the claim in the foreword that any educated reader should understand the discussion is well justified. Mr. Sauchelli has carried out that part of his task superbly well for he has achieved simplicity and clarity without their all too frequent bad companions, longwindedness and condescension.

The background of the discussion is frankly American, but in saying this one is not being critical. A note in the text clearly declares this limitation. However, on subjects that have been notably developed and studied elsewhere, *e.g.* soil fixation, granulation, the author has not hesitated to quote non-American authorities extensively.

Large industrial organisations can venture into book publication along two paths—the impressively glossy account of the organisation and its various consumer-services or the strictly technological story of its major products. The outlay involved is surely a far better investment when, as here, the latter path is chosen. For no one in agriculture can glance through this book without wanting to read it and no one will read it without gaining 'know-how' about superphosphate. Is there a better kind of long-term publicity? Perhaps we would see more of it if there were more scientists with the communicative skill and purpose of Mr. Sauchelli.

D. P. HOPKINS.

The Pesticide Handbook, 1952

Compiled and edited by Donald E. H. Fear. State College, Pennsylvania. 1952. $1.00.

We have received a copy of the latest edition of that useful publication the *Pesticide Handbook*. Like previous editions, it has been prepared under the general editorship of Professor Donald Fear, of the Pennsylvania State College, and is, as usual, replete with valuable information. Its aim is to provide concise information about all insecticides, fungicides, weedicides and other preparations manufactured in the U.S.A. This year 380 preparations are listed under their trade names and by a system of cross-references information is provided on their chemical composition, the uses to which they may be put and the firms which manufacture them. There is also information concerning their compounding, their compatability and antidotes for those which are poisonous to humans and animals.

The book packs an enormous amount of information in a handy compass. It is surprising, however, to see that, despite their widespread use in Britain and Europe, systemic insecticides do not yet seem to have become commercialised in the U.S.A.

We can only repeat our regret that the editor has not yet been able to see his way clear to include information about similar preparations produced in countries other than the U.S.A., notably Great Britain.

Nurseryman's and Mushroom Grower's Booklet

The above booklet is the 1952 edition of one that was last issued in 1950 by the Murphy Chemical Co. Since then it has been completely revised and brought up to date. The booklet contains 100 pages, nearly half of which are devoted to spraying programmes for glasshouse, fruit and horticultural crops generally, including mushrooms. Another large section covers fumigants and smokes with detailed instructions on their use. There is, of course, a list of Murphy products which has extended considerably since 1950.

'Tea Trade and Industry'

We have received a copy of the first number of a new monthly journal bearing the above title. The publication is issued under the auspices of the Calcutta Tea Merchants' Association, of which it is apparently the official organ. According to the editorial foreword, the journal was conceived for the tea industry and the tea trade against the world background. The first issue contains a number of interesting articles by well-known contributors.

PEOPLE IN THE NEWS

Top Level Changes in IH Co. of Great Britain

As from May 1, 1952, Mr. Arthur J. Purves, after a long and successful career with the International Harvester organisation, has retired from full service with International Harvester Co. of Great Britain, Ltd. He has agreed to remain a Director of the Company.

Mr. Arthur J. Purves

Mr. Brooks McCormick, who has served beside Mr. Purves since August 1, 1951, as Joint Managing Director is now named sole Managing Director. Educated at Yale University, he has spent the greater part of his service with the IH organisation in the U.S.A.

Mr. Brooks McCormick

Mr. McCormick is not only the great-great-nephew of Cyrus Hall McCormick, founder of the harvesting machinery business, but he is also great-grandson of William Deering, who fought the McCormicks for so long and eventually joined them in the formation of the International Harvester Co. in 1902.

Shell Appointments

The Shell Chemical Corporation, New York, announce that Mr. M. H. Keel has been appointed manager of a newly formed advertising department in Shell Chemical Corporation.

In his new position, Keel will direct Shell Chemical's advertising publications and sales promotion programme for agricultural chemicals, fertilisers, solvents, industrial chemicals, plastics and resins.

Mr. M. H. Keel of Shell Chemical Corporation

Another Shell promotion is for Mr. G. W. Huldrum, Jun., who has been appointed sales manager of the Western Division of Shell Chemical Corporation. Last year he became assistant sales manager, Western Division.

FARM MACHINERY

Machinery and Equipment at the 'Royal'

EACH year the machinery lines at the Royal Show, to be held this year at Newton Abbot in Devonshire, July 1 to 4, become longer and more varied; in fact, to cover all the exhibits properly would take all the four days of the Show—and more. Below we give a selection of short accounts of a representative collection of exhibitors' products which visitors will have an opportunity of seeing.

Messrs. Ransomes, Sims and Jefferies (Stand No. 347) will as usual have a wide range of farm equipment on view, including an export section. This will include two models of the Ransomes peanut (groundnut) picker, belt-driven and with capacities of 800 and 1,100 lb./hr.; the TS 62 mounted plough with two plough bodies, designed for work up to 12 in. deep; the 'Dragoon' TD 11C self-lift tractor disc plough for severe conditions and made in two-, three-, four-, five- and six-furrow sizes; the HR 20 mounted disc harrow having 18 20-in. diam. discs and maximum cultivation width of 6 ft. 6 in.; and the one-way Polydisc TD 15, available with nine, 12 or 16 discs. Amongst the many ploughs on this stand will be five specially designed for the new Fordson Major tractor. Other Ransomes' implements include a model crop drier, 'Ransomes-Lorant' 'M' type pick-up baler, thrashing tackle, low-volume sprayers and the Ford-Ransome potato digger, PD 4 B, driven by an electric motor.

The Oliver Corporation (Stand No. 182) is exhibiting the No. 8 automatic wire tying hay and straw baler, which turns out a bale 16 in. x 18 in. head size and length of 36 in., 40 in. or 44 in. The makers specify an approximate capacity of 4 to 5 tons average hay per hour or 3 to 4 tons of average straw per hour.

Turner Manufacturing Co., Ltd. (Stand No. 212) will show the Turner Diesel 'Yeoman of England' tractor, together with one-, two-, three- and four-furrow 'Yeoman' mounted ploughs. To be seen also are the 'Yeoman' hydraulic loader by Horndraulic and the 'Yeoman' mid-mounted mower by Featherstone.

Edward Curran Engineering Ltd. (Stand No. 126) will exhibit the oil-fired Slade-Curran grass drier having an output of 1½ cwt./day. This model is designed to consume 6 to 7 gal. diesel oil per hour. The coke-fired semi gas-producer model, designed to consume 70 lb. of coke per hour will be seen operating on the stand of the Gas Council (Stand No. 395). This model, incidentally, is reported to give good results using charcoal as fuel. Some hundreds of these driers are now operating throughout Great Britain and the manufacturers report that they are now investigating world markets. Two driers are already operating in Southern Rhodesia satisfactorily, while a further drier has been sent to Ceylon and is being used for drying tea.

International Harvester Company of Great Britain Ltd. (Stand No. 349) will show a wide range of equipment, as is their custom each year. This year the Company announces that it is making available an extra front wheel attachment for the McCormick International Farmall BM, produced at its Doncaster works. Named the 'Variable-Tread Front Wheel,' this consists of twin pneumatic wheels with 6.00 x 16 four-ply tyres and tubes, the stub axle being set at an angle in the centre bolster so that the wheels incline inwards. By altering the position of the rim on the wheel variation of tread can be obtained. This type of row-crop axle has been associated with American Farmall design for many years.

Wolseley Sheep Shearing Machine Co., Ltd. (Stand No. 171) will be showing a comprehensive range of products covering many phases of farming, including electric fencing, clipping machines, dairy equipment, elevators, engines and pumps. With regard to the last-named item, light alloy castings in place of galvanised iron are now being employed for the framework of the Hyject foot pump. The main design of the pump portion remains unaltered, consisting of a heavy gauge brass cylinder, incorporating an air chamber which gives a continuous action without constant pumping of the foot pedal. Three nozzles are supplied, one giving straight jet, one giving a fine spray and a third self-cleaning nozzle for use with limewash, etc.

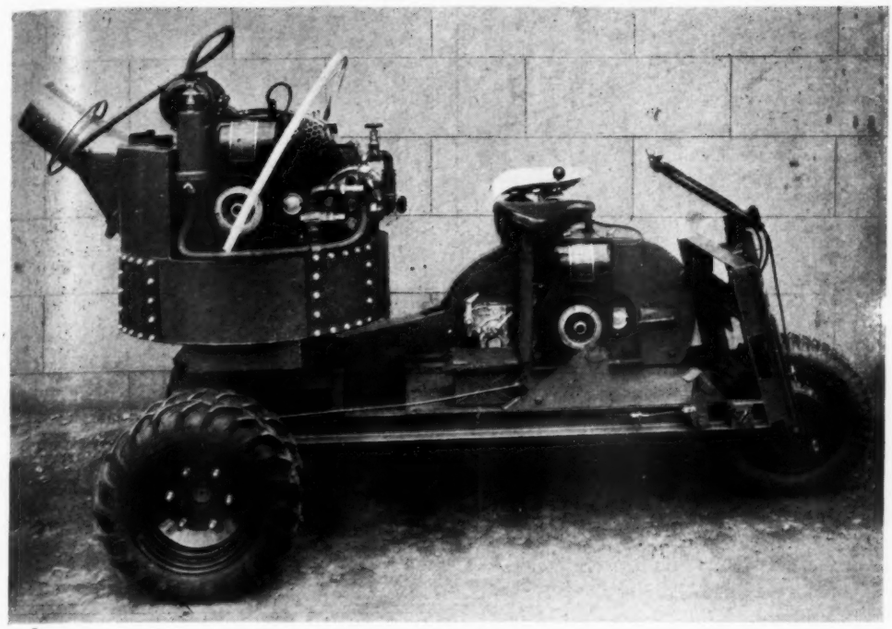
The pump's equipment includes two brass lances which can be used either singly or coupled together, a specially designed pistol fitted to 5 ft. of delivery hose and a 6-ft. length of suction hose supplied with a special strainer.

Messrs. Cooper, Pegler and Co. (Stand No. 234), manufacturers of spraying and dusting machinery, will show some entirely new machines this year, including the 'Atomiser' 600—a machine which gives an air-forced spray and exact output of 9 gal. per acre at any speed when spraying crops 16 ft. in width; it carries a 45 gal. tank. The 'Pulvover' high-powered duster for rubber, citrus, cotton, etc., is also a new machine with a container holding 150 lb. of powder, a single-cylinder 5 h.p. petrol engine and distributor which controls output from 35 to 630 lb. per hour. It is supplied either as a portable outfit or mounted on a two-wheeled chassis. Messrs. Cooper, Pegler and Co. now have new premises at Burgess Hill in Sussex, where facilities are available for demonstrations of their machines.

Wolseley Hyject foot pump, to be seen on Stand No. 171

Clifford Aero and Auto Ltd. (Stand No. 227) announce that they will exhibit two new machines at the Show. One is a garden plough suitable for mounting on the Models A1 and B Clifford cultivators and for use with standard land wheels as opposed to special large diam. wheels. The other new feature will be the re-designed Clifford light hoeing equipment, also having the advantage of being used with the standard cultivator land wheels. Other exhibits on this stand will include the tiller ridger attachment (illustrated in WORLD CROPS last month, June issue, p. 221) and the mowing attachment.

The Compton hydraulic loader for the New Fordson Major will be shown on Stand No. 315 at the Royal Show



Micron Sprayer mounted on a Nash tractor. This sprayer is being used to help fight the locust invasion in the Near and Middle East

Mitchell, Colman and Co. (Stand No. 362), makers of the Petkus range of seed cleaners and graders, will show at the Royal for the first time the P.21 model without an indented cylinder. Two bagging-off chutes are fitted in place of the indented cylinder, which can be added to the machine as a separate unit. The P.21 has a capacity of about a ton an hour.

Scottish Mechanical Light Industries Ltd. (Stand No. 178) announce that they will give working demonstrations of their exhibits, including the recently-introduced ScotMec grain blower, priced at £49 and guaranteed to convey 3 tons of oats per hour 20 ft. vertically plus 50 ft. horizontally through two 90° bends of 9 in. diam. piping. The introduction of a geared rear pulley unit has extended the range of ScotMec tractor-mounted hammer mills to any tractor, with or without rear pulley, which has a hydraulic power lift.

E. Allman and Co. (Stand No. 251) show their Model 120 universal sprayer for the first time. Having a capacity of 120 gal. (achieved by fitting three tanks), the machine is tractor-mounted and has a spraying capacity of up to 100 gal. per acre at 3 m.p.h. The spraying booms, with an effective width of 218 in., are so made that they can be raised and lowered by levers and also fold back automatically on meeting an obstruction.

Dorman Sprayer Co. (Stand No. 126) are showing a comprehensive range of their high- and low-volume crop sprayers ranging from the 250-gal. machine (£526 15s. 0d.) to the 'Junior' pneumatic sprayer (£31 3s. 6d). Eight other models will be exhibited with tank capacities of, variously, 220, 100, 50 and 15 gal., trailer and mounted models and including two low-volume acid sprayers.

David Brown Tractors Ltd. (Stand No. 97) show no less than 15 tractors and over 30 implements. All six standard tractors are included. In the four cylinder class are the Cropmaster, Cropmaster Diesel and Super Cropmaster (wheeled tractors), and the Trackmaster '30.' These are supplemented by two six-cylinder 50 h.p. machines, the Cropmaster Diesel '50' and Trackmaster Diesel '50'; both these tractors are designed primarily for the export market. Of the various specialised machines in the David Brown range, the Narrow Cropmaster (overall width 53½ in.) is included. A whole range of ancillary implements and equipment will also be on show, including associated implements. Two new associated implements this year are the Pamcol alternating one-way plough and the Teasdale folding harrow.

T. Baker and Sons, Ltd. (Stand No. 315) will show their Compton hydraulic loader for the new Fordson Major tractor. This now has strengthened jib arms and ram carrier beams, shear pins protecting the bucket tines against damage and single lever control of the bucket release and return at any height.

Clean Crops Ltd. will show their standard Micron sprayer on the stand of B.S.A. Cycles. This machine breaks up the spray liquid into almost even droplets of 100μ size (1 micron = 1/1,000 mm.), which are ejected as a cloud up to 30 ft. into the air, to drift downwind over a distance of 60 to 80 yds. The novel feature of the Micron sprayer is its rotary atomisation by means of a turbine-like atomiser, revolving at 12,000 r.p.m. This is driven by a powerful airstream generated by a paddle-fan.

The Micron sprayer first proved its worth in the battle against locusts. The Desert Locust Control in Nairobi, having made extensive trials with machinery from many countries, are reported as having found that the Micron does practically the same work as an aeroplane at an infinitely lower cost, and sprays 2 to 3 acres per minute, giving a complete kill with as little as ¾ gal. per acre. Recently FAO in conjunction with the U.S. Point Four Administration, ordered a number of Micron sprayers to help fight the disastrous locust invasion of 12 countries in the Near and Middle East.

Tests in the U.K. are at present being carried out spraying undiluted lime sulphur at the rate of 10 gal. per acre, from which Clean Crops Ltd. report promising results. This new method of orchard spraying may have far-reaching economic consequences, since the present application methods require not less than 400 gal. of spraying liquid per acre.

Plant Protection, Ltd. (Stand No. 340) exhibit for the first time at a Royal Show and their theme of 'service to world agriculture' will be illustrated by pictorial displays and maps. Technical representatives and scientists from Fernhurst Research Station will be on duty throughout the four days of the Show to deal with farmers' and growers' problems.

The Ford Motor Co. (Stand No. 292) are exhibiting seven separate versions of the New Fordson Major, together with a cutaway model of the diesel version and, by contrast, a 1917 model of the Fordson tractor. Implements on view include the general purpose and deep digger F.R. mounted ploughs, mounted three-furrow disc plough, mounted spring loaded tine cultivator, mounted ridger, Horndraulic loader, Sigman pump and Ransomes mounted triple gang mower.

Fords will also have another stand (No. 209) on which will be shown a range of 'Thames' commercial vehicles.

Rotary Hoes, Ltd. (Stand No. 325) are showing for the first time at any agricultural show two new Howard Rotavators; they are the 'Gem' Series IV, 30 in. model, with twin wheels and the same engine as the Series IV, 24 in. model, and the 36 in. model for Ferguson and Ford 8N tractors, specially designed for work in sugar cane, coffee, vines, and similar crops. The 30 in. model is at present reserved for export.

To be seen also are the Howard Rotavator 'Gem' Series III, with attachments; the 'Bantam' Series I and II, with attachments; Rotavator tractor attachments, including those for the New Fordson Major, Ferguson, David Brown Cropmaster and Super Cropmaster; the Howard haulm pulveriser; and Pasture Renovating and Picktine Rotor. The manufacturers announce that the new Rotavator for the Caterpiller D.4 tractor will not be ready in time for the Royal Show.

Harry Ferguson, Ltd. (Stand No. 322) announce that among their exhibits will be an entirely new type of steerage hoe, which has been entered for the Silver Medal award. The implement uses a hydraulic mechanism which makes each hoe gang follow the ground contour independently.

The complete range of five tractors and thirty-five implements will be displayed. The five Ferguson tractors are: the Standard Tractor, the Diesel Tractor, the Narrow Tractor (minimum overall width 54 in.), the Vineyard Tractor (minimum overall width 46 in.) and the Industrial Tractor.

Silver Medal Entries

At the time of going to press there are eight entries for the R.A.S.E. Silver Medal competition for new implements. Two of the machines, originally deferred until 1953, have been moved forward for judging this year. They are a trailer truck and an independent gang steerage hoe.

The remaining six entries are: a forage harvester, an animal spraying tunnel, a ditching machine, a silage and green crop combine, a pea cutter and swather, and a mounted reversible plough.

Technical News

A new Dutch process for drying sisal is described in the current issue of *Textile Industries and Fibres*. Progress Reports on Fertilisers are included this month in the *Manufacturing Chemist*, while *Chemical and Process Engineering* provides a chemical engineering review of crystallisation processes. A report of the last year's work of the North of Scotland Hydro-Electric Board appears in the July *Muckshifter and Public Works Digest*.

Marty Reversible Disc Plough

Exclusive rights for the manufacture and sale of the Marty reversible disc plough in the U.K. and British Commonwealth have been given to Robert Wells & Sons Ltd., of London. The plough, which was exhibited on the Ford Motor Co.'s stand at the Paris show earlier this year, is convertible from one to four discs by dismantling the independent areas which carry the discs.

The Marty disc plough is very strongly constructed and although light in weight achieves extremely good penetration without additional ballast or weights.

It is easily convertible from one to four discs as required by means of dismantling the independent arms which carry the discs. These disc-carrying arms are mounted on grooved and reversible boxes. Adjustable direction coulters are fixed to these arms for controlling the depth and ploughing efficiency of the discs; they also give free regulation of width in relation to depth of work. The independent disc-carrying arms are also adjustable and permit a variety of ploughing operations from approximately 4 to 12 in. deep and from 12 to 48 in. wide.

The Marty disc plough has three main parts, *viz.* forecarriage, main beam and disc-carrying arms. The forecarriage has a flexible connection between tractor and main beam forming a simple coupling arrangement and a triangular traction system, while the traction shaft is mounted on dust-proof bearings and has centrally-placed fittings to regulate the horizontal position of the plough. This shaft is further extended in an angling box so placed in relation to the main beam as to assure traction, lifting, return and correct setting of the working parts, with a conveniently placed hand lever governing the return movement. Along the face of this single main beam and running its entire length are two fins or ridges, so disposed as to engage with the grooves or channels of the boxes carrying the disc arms. The angling box mechanically regulates the working angle of the discs (depth of work) in giving the required setting of the entire plough in relation to the travelling axis, and the angle of work is indicated by calibration.

WORLD CROPS

OUR NEXT ISSUE—**Soil Erosion in Ceylon Tea** will be the subject of an article by Dr. B. Maclagan Gorrie. Industry's Contribution to Agricultural Research (No. 8) will feature **The Batelle Institute,** Columbus, Ohio. Also in the August issue will be the third and last of Mr. C. H. Brown's trilogy on **The Egyptian Cotton Industry.** In addition, other articles and features will appear as usual.

Mobile Fertiliser Refiner

Scottish Agricultural Industries Ltd. have designed a mobile installation for the refining of superphosphate, potash, sulphate of ammonia and other fertilisers, using a 'ScotMec' fanless 'Super Giant' (Model GM 32) hammer mill as the grinding unit.

The 'ScotMec' is mounted on a four-wheeled chassis together with a bucket elevator for continuous feeding and a screw conveyor for delivering the ground materials to the bagging-off spouts. Tramp iron (*e.g.* large bolts) are deflected from the protective screen covering the inlet hopper, whilst smaller ferrous or non-ferrous bodies entering the mill are ejected from the grinding chamber by the non-magnetic metal eliminator, a feature of all 'ScotMec' hammer mills.

The average output obtained with the GM/32 is claimed to be 6 tons per hour, using a 35-h.p. electric motor. There is a range of 11 screens available (from $\frac{1}{32}$ in. to $1\frac{3}{4}$ in. perforations) so that the materials can be ground to any fineness.

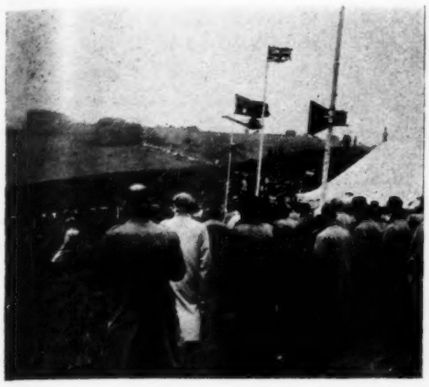
Price of the GM/32 is £140 ; it is made by Scottish Mechanical Light Industries, ScotMec Works, Ayr, Scotland, makers of tractor-mounted hammer mills, marketed by Harry Ferguson Ltd. and the Ford Motor Co. Ltd.

Marty Reversible Disc Plough (see this page). With four discs the plough weighs approx. 750 lb.

This new fertiliser spreader-cum-seeder has been added to the range of the New Holland Machine Co. of Pennsylvania. Capacity is 800 lb. of fertiliser and 8 bushels of seed in the 8 ft. model ; 1,000 lb. and 10 bushels in the 10 ft. model. Inset shows the clutch design built into each wheel for 'in gear,' 'out of gear' and 'clean'

MARGINAL LAND RECLAMATION

(*Described in* WORLD CROPS *last month*)



A section of the large crowd who attended the recent demonstration of marginal land reclamation organised by Pest Control, Ltd., in spite of rain and wind which did not seem to deter the aircraft and helicopters

A Hiller helicopter with twin spray tanks performs a tight turn at the Ivinghoe demonstration

Markjohn Mechanical Spreaders at work on hilly land

Nigerian Chieftain Yesufu Oniru (on tractor) recently spent a day with his party at the Ferguson School of Mechanised Farming, Stoneleigh, Warwicks. He was visiting England to state his case before the Privy Council concerning the Government purchase price for 11,000 acres of his land

Agriculturists Named in the Queen's First Birthday Honours

The first Birthday Honours conferred by H.M. The Queen were announced on June 5—Her 'official' birthday. Those names connected with agriculture and food production generally are listed below :

Companion of Honour

Walter Elliot, M.P., Minister of Agriculture and Fisheries, 1932-1936, for political and public services.

K.B.

Bernard Augustus Keen, Director, East African Agriculture and Forestry Research Organisation.

K.B.E.

George Sangster Dunnett, Deputy Secretary, Ministry of Agriculture and Fisheries.

C.M.G.

L. G. Fisher, Director, Oils and Fats Division, Ministry of Food.

R. D. Bakewell, Chief of the Australian Woolgrowers' Council.

C.B.E.

G. F. N. Battle, Executive Director, British Sugar Corporation, Ltd.

Major J. W. Fitzherbert-Brockholes, Chairman, Lancs Agricultural Executive Committee.

E. J. Bunbury, Chairman, Agricultural Mortgage Corporation.

A. P. Long, Director of Forestry for Wales.

B. W. Phillips, Assistant Secretary, Ministry of Agriculture.

J. T. Renton, Chairman, Agricultural Executive Committee for Eastern Area of Scotland.

Prof. E. R. Hudson, of Canterbury Agricultural College, Lincoln, New Zealand, for services to agriculture.

N. R. Jameson, Chairman of the Wool Board and Deputy Chairman of the Wool Committee, New Zealand.

L. J. Wild, of Otaki, New Zealand, for services to agriculture and education.

J. P. Edwards, Director of Forestry, Federation of Malaya.

O.B.E.

K. W. Braid, Professor of Botany, W. of Scotland Agricultural College.

H. A. Graves, Agricultural Manager, Bechuana Cattle Ranch, Colonial Development Corporation.

J. M. Hattrick, Managing Director, Potash, Ltd.

G. C. Johnson, Deputy Provincial Director, N.A.A.S., Eastern Province.

J. A. Robertson, Director of Cold Storage Division, Ministry of Food.

F. Kingdom-Ward, for service in introduction of Asiatic plants.

P. H. Haviland, Director of Irrigation, S. Rhodesia.

R. J. MacDonald, of Dannevirke, New Zealand, for services to the farming industry.

N. Craig, Deputy Director of Agriculture, Mauritius.

J. D. Jameson, Senior Botanist, Department of Agriculture, Uganda.

G. Carmichael, Senior Executive Officer, Ministry of Agriculture.

Miss E. J. Marston, Higher Executive Officer, Ministry of Agriculture.

A. A. Richards, Nursery Manager, Agricultural Experiment Station, Cheshunt.

C. T. Royle, lately Secretary, East Malling Research Station.

G. H. Stanwix, Assistant Director of Rice, Ministry of Food.

E. J. Woodward, Senior Executive Officer, Ministry of Agriculture.

SHOWS AND CONFERENCES

Cereals Conference at Edinburgh

THE holding of a joint conference of the Food and Agriculture Groups with the Scottish sections of the British Society of Chemical Industry on 'Quality in Cereals,' at the Assembly Rooms, Edinburgh, on May 8-10, was an event of interest. The conference was concerned principally with the cereals cultivated in Great Britain, *viz.* wheat, barley, oats and rye, together with their products, and took only passing notice of others, such as maize and rice.

In all, six sessions were held. The first was presided over by Sir Harold Tempany (Chairman of the Agriculture Group of the Society), who in a short opening address reviewed the position of the cereal industries of the world and pointed out the critical influence of cereal production on world prosperity and peace, emphasising the pressing need for increased production of cereals in view of rapidly expanding world populations.

Among the papers considered was one by Mr. F. R. Horne, Director of the National Institute of Agricultural Botany, on cereal agronomy, who in regard to wheat mentioned that hybridisation had broken down some of the distinctions between national types, but the type combining high milling and baking quality with higher yielding capacity in the field had not yet been produced. He mentioned also that first-generation hybrid vigour which had given such remarkable results with maize was also in evidence to some extent in the case of other cereals, citing the example of hybrids between British and Scandinavian barleys which give higher yields than either parent and have some claims to malting quality.

Mr. G. V. B. Herford, Director of the Pest Infestation Laboratory of the D.S.I.R., spoke on the subject of the protection of cereal grains, emphasising the very considerable losses at present suffered by cereals both in the field and in store after harvesting as a result of the attacks of insects and fungi; he discussed various methods for their control. Other papers at the same session included one by Dr. J. Duckworth of the Rowatt Research Institute on factors influencing cereals as food.

The afternoon session on the same day was presided over by Dr. D. P. Cuthbertson, Director of the Rowatt Research Institute. At it were read papers by Mr. D. Cameron on the agronomic character of oat varieties, Dr. J. B. Hutchinson on the influence of agronomy on the processing of oats and by Mr. K. D. Reid on the utilisation of cereal by-products.

The morning session on May 9 was presided over by Dr. B. M. Brown, Controller of the Applied Division of Brewing Industry Research Foundation, and was mainly devoted to papers dealing with the malting industry. It included a striking paper by Miss A. M. Macleod on the testing of the viability of cereal seeds, in which she described and discussed new rapid biochemical tests for viability now widely used by maltsters and grain merchants, which depend on the assumption that loss of activity of certain enzyme systems exactly coincides with loss of ability to germinate. At the same session Prof. J. A. Preece discussed the selection of barleys for malting, pointing out that, while present laboratory methods can give valuable information about the malt obtainable from a particular sample of barley, they do little to indicate the quality of the wort which the malt will provide. Mr. R. M. Thomson also read a paper on some malting methods.

At the afternoon session discussion of malting methods was continued, Mr. R. J. Potter contributing a paper on the malting of cereals other than barley. He was followed by Prof. S. J. Watson, who discussed the utilisation of barley other than malting.

The concluding session was held in the evening of May 9 and was presided over by Prof. H. D. Kay (chairman of the Food Group of the Society). The papers considered included one by Mr. Einar Moininche on rye for malting, another by Mr. J. Gordon Hay on by-products of wheat and one by Dr. J. Sword on biscuit flours. At the end of the conference Prof. Kay delivered his concluding address, in which he passed in review the work of the preceding days and expressed his view that the conference had served a very useful purpose, the papers had been very informative and the discussions full and illuminating.

The conference dinner was held on the evening of May 8 and was attended by the Lord Provost of Edinburgh. On Saturday, May 9, members of the conference visited the seed testing, plant breeding and plant pathology stations at Corstorphine and then proceeded on a visit to Gleneagles.

The Chelsea Flower Show

EXCEPTIONALLY hot weather preceded the 1952 Spring Show of the Royal Horticultural Society, held May 20-23, but by the use of cold storage and other means exhibitors managed to keep their exhibits back until the show date, when a magnificent spectacle in the marquee of nearly three and a half acres of flowers proved to be well up to the high standard of previous years. Especially well represented were rhododendrons and azaleas, a variety of the former receiving the only First Class Certificate awarded; these certificates are awarded for plants of great excellence.

Outside, in the grounds of Chelsea's famous Royal Hospital, was laid out a number of rock-and-water gardens, formal and other decorative gardens. A new introduction, from the Sociedad de Amigos del Paisaje y Jardines, of Madrid, was a reconstruction of a typical Spanish-walled garden, most of the plants and materials having been sent from Spain.

The increasing popularity of horticultural mechanical appliances was shown by the number of stands filling one avenue and exhibiting various types of garden tractor, such as the Colwood shown by Dashwood Engineering Ltd., the MG5 tracklayer, shown by Ransomes, Sims and Jefferies Ltd., and the Howard Rotavator shown by Rotary Hoes Ltd.

The field of crop protection was well represented. For instance, Bayer Agriculture Ltd. exhibited a number of recent introductions to their range of seed and other dressings, including 'Sanoturf,' a liquid fungicide for treating the underground mycelium causing fairy rings, and 'Bayacide,' a new BHC wireworm dust. May and Baker Ltd. exhibited compounds for disease prevention and treatment; also growth-promoting hormones. Plant Protection Ltd. had an attractive open-air stand where free advice on protection problems could be obtained. Other stands of note included those of the Murphy Chemical Co., Pan Brittanica Industries Ltd. and Shell Chemicals Ltd. Spraying machines, syringes, powder distributors and flame guns were shown by the Four Oaks Spraying Machine Co. Ltd.

The scientific section appeared larger than ever and there were exhibits by 11 organisations, including the research stations of East Malling, Long Ashton, Cheshunt and Rothamsted, the John Innes Horticultural Institution and Reading University Horticultural Department.

The Long Ashton exhibit which attracted considerable attention, illustrated the use of radio-active isotopes for following the movement of systemic insecticides within the plant.

New Fordson Major Demonstration—66 Machines in Operation

Staff photographer's picture of Holly Hill Farm, Middlesex, scene of the extensive 66-tractor demonstration by the Ford Motor Co.

A few of the wide range of implements designed for the new Fordson Major. The centre picture shows the conversion model for rowcrop operation in orchards, hopyards, etc.

ON May 13 the Ford Motor Co. staged at Holly Hill Farm, Enfield, Middlesex, by the courtesy of the owner, Mr. W. Fountain, what was probably the largest demonstration of agricultural machinery and equipment ever staged in Great Britain by a single firm. The occasion was intended to display the new Fordson Major tractor, recently placed upon the market, in action and the wide range of implements and machinery which have been adopted for work with the new model.

As is well known, the tractor is manufactured in three forms with, respectively, a diesel engine, a vaporising oil engine and a petrol engine. All three forms were shown working on the occasion and 66 implements were demonstrated in operation.

The machinery exhibited included a wide range of ploughs and cultivators, earth-moving machinery, including scoops, angledozers and bulldozers, machinery for hauling and lifting timber, mole drainers, pumps, spraying and dusting machinery, a portable saw-bench, root harvesting machinery, mowers and buckrakes, hammer mills and other stationary machines. The tractor was also exhibited fitted with half-track equipment and also in the county full-track form. Two interesting new conversions of the tractor were shown for operating in orchards and for row-crop cultivation between hops, vines and soft fruits.

The whole display demonstrated the amazing versatility of this modern tractor and the variety of uses to which it can be put, while the organisation of the display was an admirable example of streamlined efficiency.

Upwards of 350 people attended the demonstration, including representatives of various ministries and Government Departments, research organisations and administrations overseas. Sir Thomas Dugdale, Bt., M.P., the Minister of Agriculture, was to have been present, but was prevented by urgent Parliamentary duties; his place was taken by his Parliamentary Under-Secretary, Mr. Nicholas Nugent.

First introduced to the public at the 1951 Smithfield Show last December, we are informed that the new Fordson Major has received an enthusiastic welcome on all hands and in many countries. Nearly 10,000 have already been built and for Britain alone more than 20,000 orders have been placed. Initial shipments have been made to all the main markets of the world, where the receptions accorded to it have been even more favourable than in the U.K.

It is noteworthy that, in view of the low price and the outstanding design of the new diesel engine form, future demands for this version are estimated to be in the region of 75% of the total requirement.

Travelling Oil Exhibition

A mobile exhibition telling the farmer how the oil industry is helping agriculture, how the best performance can be obtained from tractors and other farm machinery and also to provide the backbone of a sales and publicity campaign in support of 'Agmor' products is following the British agricultural shows this summer. The trade name 'Agmor' covers a range of lubricating oils, greases and other petroleum products which are sold by Manchester Oil Refinery (Sales) Ltd.

The shows still to be visited include the Royal Counties (June 18-21), the Royal (July 1-4), Great Yorkshire (July 8-10), Staffordshire (July 16-17) and Royal Lancashire (September 3-6).

Aerial Mapping in the East

The Burmese Government has contracted with Hunting Aerosurveys Ltd. of London to carry out an aerial survey and prepare maps of reservoir and hydro-electric sites in Burma. This firm has just completed aerial mapping work for the Government of Thailand.

RESEARCH DEVELOPMENTS

Krilium Now Being Produced in United Kingdom

PRODUCTION of Krilium, the new 'wonder' soil conditioner, is now being carried out on a pilot plant scale at the Newport, Mon., works of Monsanto Chemicals Ltd. The product will be allocated to agricultural research stations in the U.K. for field trials on a variety of crops; eventually considerable capital will be allocated for the construction of a full-size Krilium plant in Britain.

Addressing the Society of Chemical Industry in London recently, Dr. D. T. Mowry, co-discoverer of Krilium, revealed a little more about this intriguing synthetic polyelectrolyte which was first announced to the world last December at the annual meeting of the American Association for the Advancement of Science (see WORLD CROPS, 4, p. 46).

The most active components of soil humus, he said, are the polyuronides and polysaccharides which are formed naturally by soil micro-organisms, but *at the same time* are broken down by other micro-organisms, and only have a life of a week or so. Hence the heavy dressings of farmyard manure required per acre.

The search for synthetic polyelectrolytes was first suggested to the Monsanto Co. by Dr. J. H. Quastel, professor of biochemistry at McGill University and late of the Agricultural Research Council in the U.K. Eventually, after synthesising over 1,000 chemicals, Dr. Mowry and co-workers found the successful polyelectrolyte which is 10 to 100 times more potent than the natural substance and is not capable of decomposition by bacteria and fungi. Today, after three years' testing in America, there is still no sign of deterioration.

This property has made the economics of production and marketing more promising and in the U.S.A. Krilium is already being sold. When large-scale production is under way it is predicted that the small packet retail price will be around $2 (14s.) a lb.

Application rates range from 100 to 1,500 lb. per acre; if the latter, no further retreatment of the soil is required.

Possible drawbacks of Krilium are that as crops grow better so do weeds; also overdosage results in the stabilisation of clods instead of soil crumbs, and it is, accordingly, most important to work Krilium into the soil and not, as with fertiliser, to spread it over the soil surface and leave it to be washed down by rain.

One of the principal raw materials for the preparation of Krilium is acrylonitrile which can be produced from petroleum and/or coal. A $60 million plant is at present being built by the Monsanto Chemical Co. in Texas, which will produce mainly acrylonitrile at the rate of 100 million lb. per year. Meanwhile, tests on other types of polyelectrolytes are going on and it is possible that a more potent one than Krilium may be found, which might result in a lowering of the price of the finished product.

The primary emphasis at present for the use of Krilium is on intensively-grown horticultural crops; for use by the general farmer the outlook is more on a long term basis.

In Great Britain Krilium is being tested, in co-operation with the Agricultural Research Council, at ten agricultural research stations. Further trials are being organised by the National Agricultural Advisory Service at various centres under its control. The number of organisations carrying out trials is expected to increase considerably as supplies of Krilium become available and as the field of investigation is widened.

The trials, which will cover a wide variety of British soil types, are designed to obtain information on production and maintenance of good soil structure, workability, moisture relationship, germination of test crops, rate of growth, and crop yield and quality.

Crops which are being studied are barley, carrots, chrysanthemums, clover, grasses, lettuce, oats, strawberries, sugar-beet, tomatoes, tree seedlings, tulip bulbs and wheat.

Dr. David T. Mowry, co-discoverer of Krilium

Control of Argentine Ants—Results in New South Wales

Following the discovery of Argentine ants in New South Wales in 1951 (mentioned in an editorial comment in WORLD CROPS, 3, p. 88), it was decided to carry out a series of experiments to determine the most effective method of fighting these pests, and to this end a co-operative project was undertaken by the Commonwealth Scientific and Industrial Research Organisation and the New South Wales Department of Agriculture.

The following paragraphs, extracted from a recent issue of the *Agricultural Gazette* of New South Wales, summarise the results and the conclusions drawn therefrom:

'Three comparative experiments were carried out at Lidcombe, New South Wales, and an attempt made to eradicate the Argentine ant from an isolated infestation of 9½ acres around Platform Street, Lidcombe, and from an invasion into the resting paddocks of the state abattoirs.

'A method of applying a grid of barrier sprays, developed during the investigations, consisted of laying down a succession of barriers around houses, or within infested areas, in such a manner that the ants must cross a barrier to reach food or a favoured nesting site.

'The activity of the ants was measured by a system of assessing the density of the trails occurring in standard positions around each residential block.

'All treatments applied—2% DDT dust, 1% and 2% DDT emulsion spray, 0.5% gamma BHC emulsion spray and 1% and 2% chlordane emulsion sprays—considerably reduced populations of ants.

'The 2% chlordane spray was the most effective all-round spray, but was closely followed by the 2% DDT spray and both produced long-lasting residual effect. Although 1% chlordane controlled the ants, the period of complete control was much shorter than for 2% chlordane. One per cent. DDT and 0.5% gamma BHC were also inferior and the dust containing 2% DDT was unquestionably the least effective treatment.

'A mixed spray containing 1% chlordane plus 1% DDT was as effective under wet summer conditions as the 2% chlordane.

The inclusion of 2% chlordane in floor polish resulted in a high mortality of ants crossing polished barriers.'

WORLD CROP REPORTS — Tobacco Crop

U.S.A.

1952 forecast. Reports dated March 1 suggest a total area under tobacco in 1952 of 1,804,000 acres which, although only 21,000 acres more than in 1951, is the largest acreage under this crop since 1947. The areas under the various types of leaf this year show similarly small variations from last year's figures, the area under flue-cured, for example, being estimated at 1,122,000 acres, as compared with 1,110,000 in 1951. The largest single change is in the area under Burley, estimated at 469,000 acres, or 14,000 acres more than last year; for the remaining types the maximum expansion or contraction barely exceeds 3,000 acres. Compared with 1938, the total anticipated 1952 acreage is greater by 203,000 acres, but, while the areas under flue-cured and Burley show increases of 213,000 acres and 62,000 acres, respectively, the current area under fire-cured has fallen to less than half the 1938 figure and that under dark air-cured has also shown a considerable decline; the total cigar leaf acreage is also less than in 1938, but the area producing the especially highly-priced wrapper leaf is now larger by nearly one-quarter than before the war. The acreage changes since 1938, of course, reflect the increasing popularity of cigarette smoking as against pipe-smoking and tobacco-chewing and, in the case of cigar tobacco, the lessened availability of wrapper leaf from Indonesia.

Assuming yields per acre equal to the 1947-51 average, the total 1952 crop should amount to some 2,222 million lb., or 62 million lb. less than in 1951. Flue-cured production on the same assumption should amount to about 1,380 million lb., 54 million lb. less than last year, while the Burley crop at 590 million lb., on the other hand, should show an increase of 7 million lb. Yields per acre for most types were exceptionally heavy last year, so that despite slightly increased acreages this year total production may well fall below the high figure of 1951.—From *Tobacco Intelligence*.

ARGENTINA

More than last year. The country's 1951-52 tobacco crop is estimated at 81.6 million lb. from 91,427 acres, compared with earlier forecasts of 83.8 million lb. from 91,427 acres. Flue-cured leaf production for 1951-52 is expected to be about 13.2 million lb. Argentina's 1950-51 tobacco production is estimated at 77.2 million lb. from 84,500 acres.

CHINA

Flue-cured increase. China's 1951 flue-cured tobacco production is unofficially estimated at more than treble the 1950 output, according to the American Consulate, Hong Kong.

The country's 1951 flue-cured leaf production is placed at 260 million lb. from about 297,000 acres. This corresponds to the 1950 flue-cured harvest of 80 million lb. from 81,000 acres. Yield per acre during 1951 was only 877 lb., compared with 987 lb. in 1950.

BRAZIL

Lower forecast. Brazil's 1951-52 tobacco production is estimated at 14% below earlier forecasts, according to the American Consulate, Port Alegre.

The country's 1951-52 tobacco production is now placed at 207.2 million lb. from 297,800 acres, compared with earlier forecasts of 240.7 million lb. from 302,700 acres. The 1950-51 leaf harvest is estimated at 232.3 million lb. from 296,800 acres. This downward revision is attributable to drought conditions in Bahia and Rio Grande Do Sul, the two most important tobacco-producing Brazilian states.

ITALY

Tobacco production higher; imports and exports lower. Italy's 1951 tobacco production is estimated at 176.4 million lb., compared with 172 million lb. in 1950.

Imports of unmanufactured tobacco during the first 11 months of 1951 totalled 5.6 million lb., compared with 9.1 million lb. in the same 1950 period. Greece, the most important unmanufactured tobacco source during the 1951 period, supplied 3.5 million lb. Turkey supplied 952,378 lb.; the Soviet Union supplied 881,840 lb.

Exports of unmanufactured tobacco during January-November 1951 totalled 17.4 million lb., compared with 21.6 million lb. in the comparable 1950 period. The Soviet Union, the most important 1951 export outlet, took 3.5 million lb. The Netherlands took 3.3 million lb.; Western Germany 2.2 million lb.; the United Kingdom 2 million lb. Other countries taking unmanufactured tobacco during this 1951 period included Belgium-Luxembourge, France, Sweden, Switzerland, Spain, the United States and Uruguay. During 1950 Poland took 4.7 million lb. of Italian leaf.

BRITISH EAST AFRICA

Nyasaland production. There is no official crop estimate this year, but it is expected that, largely owing to the particularly wet season, the production of fire-cured and sun-cured will be less than last year; the flue-cured crop has, however, suffered less from the excessive rains.

Exports. Exports in the first two months of 1952 were seasonally small, totalling only 1.7 million lb., as against 1.4 million lb. a year ago, and in both cases consisting almost entirely of dark-fired leaf. Over three-quarters of the total exports this January-February went to various African markets, principally Sierra Leone, Egypt and the Belgian Congo, consignments to the United Kingdom having been negligible.

Northern Rhodesia production. Preliminary reports place the total current crop at 13 million lb., or 2.1 million lb. more than last year, flue-cured production in the north-western area having expanded by a further 2.2 million lb., as against a small decline in the north-eastern area. Comparative figures of the current crop and sales of last year's crop are as follows:

	1950-51 (1,000 lb.)	1951-52 (1,000 lb.)
North-eastern area:		
Flue-cured	4,414	4,250
Burley	253	250
North-western area:		
Flue-cured	6,262	8,500
Total	10,929	13,000

Southern Rhodesia production. The preliminary estimate for the current crop is 115 million lb. (wet weight), flue-cured, from 193,000 acres and 845,000 lb., fire-cured, from 1,300 acres, as compared with 87.5 million lb., flue-cured, from 172,000 acres in 1950-51. The flue-cured crop which, although a little light owing to excessive rain, is good in quality, will thus be nearly 10 million lb. heavier than in 1949-50 when Southern Rhodesia's tobacco reached its previous highest figure. Under the agreement between Rhodesian growers and United Kingdom manufacturers, the latter should receive 75 million lb. of the current Rhodesian crop, or 27 million lb. more than British purchases of last season's crop.

MADAGASCAR

Lower crops; higher consumption. Madagascar's 1951-52 leaf crop is tentatively estimated at 8.6 million lb. from 13,183 acres. This compares with 11.7

million lb. from 21,139 acres during 1950-51.

Exports of unmanufactured tobacco during 1951 totalled 9.6 million lb., compared with only 6.3 million lb. in 1950. France took 99% of all 1951 exports.

Imports of tobacco and tobacco products during 1951 totalled 975,755 lb., compared with 701,841 lb. during 1950.

Consumption of tobacco during 1951 is estimated at almost 2.3 million lb., compared with 2 million lb. in 1950.

INDIA

Further decline in area. According to the Intelligence Branch of the Commonwealth Economic Committee, the area under tobacco this year is expected to total 743,000 acres, as against 839,000 acres last season and 860,000 acres in 1949-50.

PHILIPPINES

Increase of 9% anticipated. The country's 1951-52 tobacco production is tentatively estimated at 71.6 million lb. from 138,400 acres. This corresponds with 65.8 million lb. from 125,600 acres during 1950-51 and 58.2 million lb. from 118,500 acres in 1949-50. Reports indicate a larger harvest of flue-cured leaf than in 1950-51 when unofficial estimates place the output at about one million lb.

World Flue-Cured Tobacco Production at a New Record Level

The estimated world flue-cured tobacco production of 2,377 million lb. during the fiscal year July 1951-June 1952 surpasses the preceding year's record level of 1,988 million lb. by 20% and the 1949-50 output of 1,811 million lb. by 31%. Substantial increases in output occurred in many of the important producing countries and especially in the United States, China, Southern Rhodesia and Canada. Decreases were recorded for Brazil, the Union of South Africa, India, Pakistan and New Zealand.

Increased world demand for flue-cured leaf, used mostly in the manufacture of Virginia-type and United States' blended cigarettes, has resulted in a progressive increase in output of this type of tobacco. Consumers in practically all countries are shifting from products containing dark and cigar tobacco to flue-cured and other light types used principally in cigarettes. Effective world demand for flue-cured leaf, especially United States' flue-cured, would probably be substantially larger if it were not for restrictions by many countries on the use of foreign exchange for the import of tobacco. The table below is reproduced from the U.S. Department of Agriculture's *Foreign Crops and Markets*.

CANADA

Drastic acreage reduction. The Flue-cured Tobacco Marketing Board of Ontario has set this year's acreage for its members at two-thirds of the base acreage, or 78,000 acres, as compared with the 106,260 acres under flue-cured last year; in order strictly to enforce this reduction, the Board plans to measure all crops, and the former 2% tolerance in acreage measurement will not be allowed. This drastic reduction in the area under flue-cured is a result partly of the anticipated cut in the dollars available for United Kingdom purchases of tobacco from the 1952 crop and partly of the decline in Canadian domestic consumption following the higher price of cigarettes—although the recent budget has now rescinded last year's increase in tax on raw leaf and cigarettes. The 1952 acreage allotment for Burley has also been reduced by the Burley Tobacco Marketing Association to 70% of the 1951 base acreage, or 2,400 acres; as recently as 1949 the area under Burley had exceeded 11,000 acres. In Quebec the directors of the two cigar tobacco co-operatives have fixed total production of cigar leaf for the current year at 1.8 million lb., or less than half last year's crop; while cigar consumption in Canada in 1951 was no higher than in 1940, stocks of cigar leaf have shown a steady rise.—From *Tobacco Intelligence*.

FLUE-CURED TOBACCO

World Acreage and Production, 1951, with Comparisons*

Country	Acreage				Production			
	Average 1935-39	Average 1949	1950	1951†	Average 1935-39	Average 1949	1950	1951†
	Acres	Acres	Acres	Acres	1,000 lb.	1,000 lb.	1,000 lb.	1,000 lb.
Canada	50,703	90,733	92,080	111,020	54,616	116,668	108,202	141,625
Mexico	‡	‡	‡	‡	800§	4,630	3,750	3,858
United States	981,400	935,400	958,400	1,110,100	863,620	1,114,508	1,257,280	1,433,650
Italy	‡	8,157	9,214	10,853	2,846	14,775	19,460	21,164
China	132,800	‡	80,723	297,000	150,900	‡	80,000	260,000
Manchuria	10,540	‡	‡	‡	13,930	‡	‡	‡
Pakistan	‖	1,600	5,500	4,500	‖	1,308	4,165	4,000
India	67,000§	150,000	‡	‡	31,280	95,400	104,500	95,000
Japan	40,830	51,346	64,665	72,911	62,350	67,608	105,600	108,704
Taiwan (Formosa)	1,988	16,595	12,444	14,245	3,235	18,982	12,278	17,196
Korea	7,674	13,118	16,233	‡	11,839	22,146	21,600	‡
Thailand (Siam)	‡	33,620	45,600	56,000	‡	9,920	13,974	16,535
Argentina	955§	6,425	12,355	12,385	918§	6,173	11,023	13,228
Brazil	‡	32,247	32,123	33,606	‡	43,375	44,974	33,069
Nyasaland	‡	5,000	‡	‡	2,574	2,604	4,010	4,000
Northern Rhodesia	‡	15,500	‡	‡	‡	7,000	10,149	14,000
Southern Rhodesia	48,010	152,717	172,000	192,000	24,623	105,492	87,500	110,000
Union of South Africa	‡	32,201	‡	‡	4,996	22,108	21,442	17,800
Australia	9,913	4,561	6,628	7,678	5,276	4,138	4,250	6,450
New Zealand	1,740	3,899	3,950	3,666	1,370	4,700	5,500	5,000
All Other Countries**	37,170	215,015	316,482	235,565	2,682	149,654	68,070	71,313
Estimated World Total	1,390,723	1,768,134	1,828,397	2,261,529	1,237,855	1,811,189	1,987,727	2,376,592

*Year beginning July 1. For north temperate zone countries, harvests July through October of the year shown; for all other countries, harvests January through June of the following year.

†Preliminary.

‡Data not available.

§Less than a five-year average.

‖No flue-cured production in pre-war years.

**Includes approximations for countries not listed and where data not available.

Office of Foreign Agricultural Relations. Official estimates of foreign countries, reports from U.S. Foreign Service Officers, results of office research and other information.